The Mortality Experience of Industrial Policyholders

(1916—1920)

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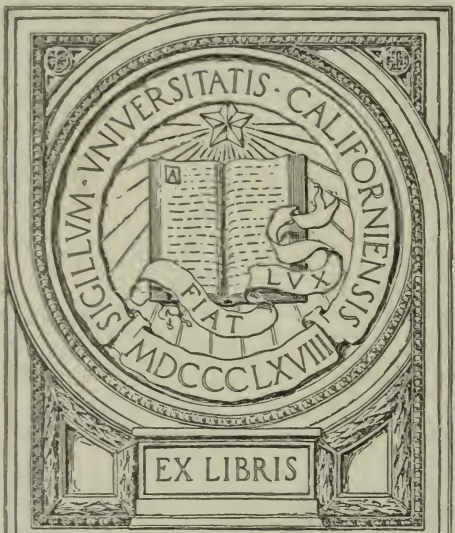

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The Mortality Experience
of
Industrial Policyholders
1916–1920

A Contribution *to the*

Public Health Movement in America

by the

Colonial Life Insurance Company of America
John Hancock Mutual Life Insurance Company
Life Insurance Company of Virginia
Metropolitan Life Insurance Company
Prudential Insurance Company of America

NEW YORK, 1923

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1923

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PREFACE

The discussion of a proposal to study collectively the statistics of mortality of industrial policyholders in the United States and Canada dates back almost ten years. It was early recognized that the statistical materials on the causes of death of insured wage earners were valuable and instructive, not only to the companies themselves, but also to the officials of public and private agencies and to others engaged in the advancement of community well-being. The primary records were on file in the offices of the insurance companies; it remained only to develop a common purpose among the companies, to establish uniformity and high excellence in the abstraction, classification and tabulation of the facts, and to place these important materials at the disposal of students of public health and of insurance medicine.

The suggestion which led to the organization of this cooperative effort by the industrial insurance companies was first made by Dr. Frederick L. Hoffman, formerly Third Vice-President and Statistician for the Prudential Insurance Company of America, and now its Consulting Statistician. In this, as in many other instances in his constructive career, Dr. Hoffman's initiative gave rise to a programme of timely and useful investigation into the items which make for the welfare of the great body of working people in the United States and Canada. After a preliminary correspondence, an organization committee of the several companies was effected and a conference was held on June 29, 1914. The representatives of the statistical staffs of the Prudential and of the Metropolitan, and of the actuarial staffs of the John Hancock Mutual Life Insurance Company, the Life Insurance Company of Virginia, the Colonial Life Insurance Company of America and the Western and Southern Life Insurance Company were brought together and authority obtained from the Executives of the several companies to proceed with the project of a combined study of industrial mortality statistics.

The Committee realized at the very outset the extraordinary opportunity that it had to make valuable additions to the knowledge of life and health of the great body of the American people. Everything depended upon setting the highest standards in conformity

with the best practice of the Federal statistical agencies. Accordingly, the Committee adopted as its primary classification guide the *Manual of the International List of Causes of Death* (1909 revision), the rules of the United States Bureau of the Census for the treatment of jointly returned causes of death, supplemented by the *Index of Joint Causes of Death* issued by that office. The Committee also adopted a system of direct correspondence with physicians to secure additional and more accurate statements of certified causes of death. It recommended the establishment of suitable mechanical tabulation facilities in each of the companies and put into operation uniform schedules for the use of each company in reporting to the central office the tabulated material of each organization. Finally, a common method was agreed upon for estimating the number of lives exposed to risk from the mean number of policies known to be in force. The Committee met annually, reviewed and simplified its methods, and prepared for use by each of the companies a series of comparative tabulations.

The results of the Committee's work, as shown by the 1916 conference, convinced the Executives of the several companies that worthwhile data could be presented for a period of five succeeding years. Arrangements were accordingly made for the combined investigation shown in the following pages. The extraordinary value of the information to be collected was little realized at that time. The influenza and war experiences were still to come. The present report shows the effect of these two occurrences upon the mortality experience of the wage earners in the United States and Canada. As might be expected, these two extraordinary occurrences have been stressed. The Committee collected much information on other phases of the mortality experience of industrial policyholders, but only the more obvious facts have been set forth. The material now available suggests the utility of further study. It is to be hoped that the Committee may make some contribution in the future to show the effect of recent economic advances upon the mortality experience of wage earners in current and succeeding years.

It should be pointed out that the establishment of such a system of cooperative record keeping and reporting by the several companies was not easily accomplished. The smaller companies had to develop a plan of statistical investigation almost from the very foundations. Even the larger ones had to adapt their own systems of statistical procedure to one which would harmonize with the plans initially

outlined at the 1914 meeting. It is remarkable how completely the several companies adapted themselves to the requirements of the case. Unfortunately, the Western and Southern Life Insurance Company could not make available the estimated number of lives exposed to risk for the entire five-year period of the investigation and, for that reason, the data for that company could not be combined with the others. In other respects, the contribution of the facts by the Western and Southern Life Insurance Company was highly satisfactory and it is much to be regretted that the experience of this growing organization had to be omitted. Apart from this omission, the experiences of all of the other industrial companies became available in such form that they could be combined into the report which follows.

The publication of the report has been long delayed by the pressure of work in the offices of the several companies. The report is, therefore, presented in somewhat contracted form. There is much more material available in the files of the Committee and, as opportunity offers, further analyses may be prepared. Public response to this report, however, will determine whether the continuation of publications of this type by the companies in future years is warranted.

The report has been prepared under the general direction of the Committee whose names appear on page III. The consolidation of the experience of each of the companies was conducted in the office of the Statistical Bureau of the Metropolitan Life Insurance Company. The graphic and textual material was prepared by Mr. E. W. Kopf, Assistant Statistician, and Mr. George H. Van Buren, Supervisor of the Statistical Bureau of this Company. The Committee desires to express its obligation to the Executives of the several companies who furthered this inquiry at every point and voted sufficient funds for the compilation and its publication.

Louis I. Dublin,
Chairman.

April 18th, 1923.

CONTENTS

PREFACE ..... V–VII

Chapter I—INTRODUCTORY 3–14

Scope of the Report——Age and Sex Constitution of the Insured Group——General Mortality Data of the Investigation——Relatively Greater Fall of Mortality Rates among Insured Wage-earners——Mortality in Specified Age Divisions.

Chapter II—PRINCIPAL CAUSES OF DEATH 15–17

Chapter III—TUBERCULOSIS 17–28

The Tuberculosis Death Rate in Comparison with the Rates for the other Causes of Chief Numerical Importance——Deaths and Death Rates for Tuberculosis (all forms) by Age Groups——Comparison of Tuberculosis Death Rates, by Age, among Insured Wage-earners and in the General Population——Declining Death Rate from Tuberculosis among Insured Wage-earners in Cities and in the United States Registration Area, 1916 to 1920.

Chapter IV—INFLUENZA 29–39

Death Toll of the Influenza of 1918–1919——Age Characteristics of Pandemic Influenza——The Influenza of 1918——Influenza in 1919——Influenza in 1920——Age Characteristics of Influenza in the Five-year Period, 1916 to 1920——Influenza in Relation to Economic Status——Influenza among Insured Wage-earners and in General Population Compared.

Chapter V—PNEUMONIA 39–43

Comparison of the Recorded Mortality from Pneumonia (all forms), Lobar Pneumonia and Bronchopneumonia, 1916 to 1920——Importance of Pneumonia as a Cause of Death in Non-Epidemic as well as Epidemic Years——Age Characteristics of Recorded Pneumonia Death Rates——Pneumonia Mortality among Insured Wage-earners and in the General Population.

Chapter VI—ORGANIC DISEASES OF THE HEART 44–52

Heart Disease an Important Cause of Death at All Age Periods——Heart Disease among Insured Wage-earners and in the General Population——Preventability of Heart Disease Mortality——Heart Disease and the Influenza Pandemic of 1918.

Chapter VII—Bright's Disease..... 52–56

Chronic Bright's Disease the Fifth Cause in Numerical Importance during the Period 1916–1920; the Fourth Cause under Non-Epidemic Conditions of 1916–1917 and 1920——Deaths and Death Rates from Bright's Disease 1916 to 1920 by Age Periods——High Death Rate in Comparison with General Population with Discussion of Factors Causing this Condition.

Chapter VIII—Accidents (Including Unspecified Violence) 56–79

Accidents Sixth in Numerical Importance among the Causes of Death——Important in Every Age Group——Death Rates from Accidents among Wage-earners and in the United States Registration Area Compared by Age Groups——Types of Fatal Accidents——Traumatism by Fall——Traumatism by Automobile——Accidental Drowning——Burns (Conflagration Excepted)——Railroad Accidents——"War Deaths."

Chapter IX—Suicide..... 79–82

Deaths Classified Under this Heading where Fact of Suicide was Established——Suicide Rare among Children but Assumes Importance during Adolescence——Suicide Death Rate Declined Materially and Continuously during Five-year Period——Probable Factors Operating to Cause Lower Suicide Mortality during the War and Immediate Post-War Period ——Comparison of Deaths and Death Rates from Suicide among Wage-earners and in the General Population.

Chapter X—Homicide..... 82–86

Deaths Classified under this Heading Only When the Fact of Homicide or Attempt at Homicide is Clearly Shown—— Death Rates by Age Periods——Little Change in the Homicide Situation among Wage-earners during the Period 1916 to 1920——Homicide in the General Population 1900 to 1920.

Chapter XI—Cancer..... 86–90

Cancer the Seventh Cause in Numerical Importance——Considerable Mortality in Childhood from Sarcoma——Cancer Death Rate Increases with Age——Relative Incidence of Cancer among Wage-earners and in the General Population ——Close Association Between Low Economic Status and High Cancer Death Rate.

Chapter XII—Cerebral Hemorrhage, Apoplexy..... 90–93

Cerebral Hemorrhage Eighth in Importance among the Causes of Death; seventh in Importance in Non-Epidemic Years—— Number of Deaths and Death Rates by Age Groups—— Accuracy of Reports of Cerebral Hemorrhage Subject to Grave Doubt when Death Occurs under Fifty Years of Age ——Probability that Brain Hemorrhages in Ages under Fifty are Secondary or Terminal Manifestations of Cerebral Syphilis——No Pronounced Upward or Downward Tendency in the Death Rate during the Period 1916–1920——Comparison of the Death Rate among Wage-earners and in the General Population by Years and Age Groups.

Chapter XIII—The Four Communicable Diseases of Childhood: Measles, Scarlet Fever, Whooping Cough and Diphtheria 94–105

Relative Numerical Importance of These Diseases——Age Distribution of Deaths for Each——*Measles* Ranked as the Second Cause among the Four——Measles Important Cause of Mortality during First Decade of Life Only——Measles Mortality Fluctuates from Year to Year——Comparison of Death Rates Year by Year and for Important Age Groups among Industrial Policyholders and in the General Population——*Scarlet Fever* had Lowest Death Rate of the Four Principal Epidemic Diseases——Forty-five per cent. of the Mortality from this Disease Occurs among Children One to Four Years of Age——Scarlet Fever has a Lower Death Rate than either Measles or Whooping Cough but a Much Higher Case-Fatality Rate than in the General Population——Scarlet Fever Death Rate Fluctuates from Year to Year——Rising Tendency in the Death Rate during the Period 1916 to 1920 ——*Whooping Cough* Third in Numerical Importance among the Four Principal Epidemic Diseases of Childhood—— Whooping Cough Mortality and Morbidity Reaches its Maximum in the First Year of Life for which No Figures are Available in this Insurance Experience——Whooping Cough Nevertheless a Very Important Cause of Death at Ages One to Four——Death Rate Varies Widely from Year to Year—— Comparison of Death Rates Year by Year and by Age Periods among Industrial Policyholders and in the General Population ——*Diphtheria*——Diphtheria the Leading Cause of Death among the Four Principal Epidemic Diseases of Childhood—— Mortality Greater than Combined Mortality from Measles, Scarlet Fever and Whooping Cough——One of the Most Important Causes of Death in the Early Age Periods—— Diphtheria the Leading Cause of Death among Insured Children in the Age Group Five to Nine Years——Tendency of the Death Rate During the Quinquennium Slightly Upward ——This Situation Discouraging for a Disease toward which Attention of Public Health Officials has been so Strongly Directed——Death Rates Compared Year by Year among Insured Children and in the General Population.

Chapter XIV—Diarrhea and Enteritis 105–107

Bulk of the Mortality Occurs in First Year of Life and is Not Covered by Present Study——Diarrheal Disease Nevertheless an Important Cause of Death in Industrial Insurance Experience——High Death Rates in Age Group One to Four Years and in Old Age——Death Rates Compared Year by Year and by Age Groups among the Industrial Policyholders and in the General Population.

Chapter XV—The Puerperal State 108–126

Importance of Mortality from Puerperal Conditions from the Standpoint of Relative Numerical Importance Regardless of Sex——Relative Importance among Women and Relative Status among Females of Childbearing Ages——Number of Deaths and Death Rates by Age Groups——Effect of the Influenza Epidemic upon the Puerperal Death Rate——Mortality Compared Year by Year and by Important Age Groups among Industrial Policyholders and in the General Popula-

Chapter XV—*continued.*

tion——Trend of the Death Rate 1916 to 1920——Types of Puerperal Disease——Considerable number of Indefinitely Reported Cases——Death Rates from Important Types during the Quinquennium and for Each Year——*Puerperal Septicemia*——Septicemia the Leading Cause of Death from Disease Incidental to the Maternal State——Number of Deaths and Death Rates by Age Periods among the Industrial Policyholders——Death Rates Compared Year by Year and for Age Groups among Industrial Policyholders and in the General Population——No Definite Upward or Downward Tendency in the Puerperal Septicemia Death Rate during the Period 1916 to 1920——*Puerperal Albuminuria and Convulsions*——Ranks Next to Septicemia in Numerical Importance——Number of Deaths and Death Rates by Age Periods ——Death Rates Year by Year and by Age Groups Compared among Industrial Policyholders and in the General Population——*Accidents of Pregnancy*——Ranks Third to Septicemia and Albuminuria among Puerperal Diseases——Death Rates by Age Groups——Death Rates Year by Year and by Age Groups among Industrial Policyholders and in General Population Compared——Mortality from Accidents of Pregnancy Highest in Years in which Influenza Prevailed——Slightly Higher Death Rates for Insured Women than for Those of General Population——*Accidents of Labor*——Fourth in Numerical Importance among Diseases Incidental to the Maternal State——Number of Deaths and Death Rates by Age Periods——Death Rates Year by Year and by Age Periods among Industrial Policyholders and in the General Population Compared——Maximum Mortality in Years in which Epidemic Influenza Reached its Highest Prevalence.

Chapter XVI—Diseases of the Arteries..... 126–129

Majority of Deaths Certified as due to Arteriosclerosis——Considerable Number of Deaths from Aneurysm——Few Deaths in Lower Age Groups——Number of Deaths and Death Rates by Age Groups——Death Rates Year by Year and by Age Groups among Industrial Policyholders and in General Population Compared.

Chapter XVII—Diabetes..... 129–132

Relatively Unimportant at Earlier Ages——An Important Cause of Death Beginning with Age Thirty-five——Maximum Mortality in Old Age——Number of Deaths and Death Rates by Age Periods——Continuous Decline in the Death Rate from 1916–1919 with Rise in 1920——Probable Factors Causing this——Death Rates Year by Year and by Age Groups among Wage-earners and in General Population Compared.

Chapter XVIII—Appendicitis..... 132–134

Number of Deaths and Death Rates by Age Periods——Fairly Uniform Death Rate for All Age Periods Except One to Four Years——Death Rates Year by Year among Wage-earners and in the General Population Compared.

Chapter XIX—Cirrhosis of the Liver 134–137

Of Little Importance Before Age Thirty-five——Death Rate Considerable in Higher Age Groups——Number of Deaths and Death Rates by Age Groups——Tendency of Death Rates Continuously Downward During Period 1916 to 1920 ——Death Rates Year by Year and by Age Groups among Wage-earners and in General Population Compared.

Chapter XX—Typhoid Fever 137–139

Death Rate for Typhoid Fever Excellent Gauge to Progress of Sanitation——Typhoid Death Rate among Industrial Policyholders Declined Continuously Throughout the Period 1916 to 1920——Greater per cent. Reduction among Wage-earners than in the General Population——Death Rates Year by Year among Wage-earners and in the General Population Compared.

Chapter XXI—Acute Poliomyelitis 139–141

High Mortality in Year 1916, Especially in Middle Atlantic and New England States——Primarily a Disease of Early Childhood——Adults not Immune——Death Rates Year by Year and by Age Groups among Wage-earners and in General Population Compared.

Chapter XXII—Cerebrospinal Fever 141–143

Maximum Mortality in Early Childhood——Mortality among Adults Higher in 1917 and 1918 than in Other Years Due to Considerable Number of Deaths in Mobilization Camps—— Number of Deaths and Death Rates by Age Groups—— Death Rates Year by Year among Wage-earners and the General Population Compared.

Chapter XXIII—Pellagra 143–146

Geographic Incidence——Almost All the Mortality Reported from Southern States——Statistics Available for Only Two of the Five Cooperating Companies——Number of Deaths and Death Rates by Age Groups——Pellagra has Distinct Age Incidence——Increasing Death Rate After Age Twenty-five——Death Rates Year by Year among Industrial Policyholders and in the General Population Compared——Negroes have Higher Rates than Whites——Pellagra has Pronounced Sex Incidence in the United States with Relatively High Mortality among Females——Important Public Health Problem in Certain Parts of the South.

Chapter XXIV—Malaria 146–147

More Important as a Cause of Physical Disability than of Death——Higher Morbidity and Mortality Rates among Colored People than Whites——Still Ranks High as a Cause of Death in Certain Southern States——Most Fatal in Early Childhood and Old Age——Number of Deaths and Death Rates by Age Groups.

Appendices 148–150

REPORT ON THE MORTALITY OF INSURED WAGE-EARNERS IN THE UNITED STATES AND CANADA, 1916-1920

A Cooperative Study by the Industrial Life Insurance Companies of America

I. INTRODUCTORY

(a) Scope of the Report

The following report is a contribution by the American Industrial life insurance companies to the knowledge of the facts of life and health among the wage-earning population of the United States and Canada. The executives of these companies realize the exceptional value of the data in their possession for the development of the public health movement. They have combined their resources in order to make this contribution of the greatest possible value and as representative of the whole field of the public health statistics of industrial insurance, rather than that of the individual companies.

The industrial life insurance companies are in a favorable position to gather the facts on the conditions of life and health among wage-earners. In the first place they reach large numbers of the wage-working population. Industrial insurance is practically whole-family insurance. The policyholders include men, women and children. No race or nationality is excluded by all of the companies. White and colored policyholders, the native and foreign-born, are represented, as are also the various nationality groups of the foreign-born population. The companies must keep accurate records of the number of their policyholders, currently, because premiums are collected at short intervals; in most cases weekly. They have what amounts to a weekly census of the insured population. The facts of this weekly census, averaged for the year, are also available with a fair degree of accuracy by broad age periods at the end of each calendar year. Equally important is the fact that the companies have timely records of deaths which occur among their policyholders, for such records are a condition for the prompt payment of claims. These records are illuminating documents of importance to the

medical and public health professions, containing such information as the cause of death and duration of disease, the occupation of the insured, the age, and the family relationships. These two sets of data for the living and the dead make the most valuable collection extant of statistics on mortality. In the nature of the case, they excel in accuracy, in timeliness, and in wealth of detail, the data available to governmental agencies through the process of official registration.

In a certain real sense, the mortality statistics of the Industrial companies are unique. They relate to a *specific* group of the population, namely, the wage-earners, who, while they represent a large part of the total population, are, nevertheless, particularly interesting as a group. Official statistical organizations cannot make such distinctions in their reports. The records of health and disease compiled from general community sources are, of course, very useful; but they relate to such broad groups, of such diverse composition with respect to economic and social conditions, that it is difficult to use them always with precision in disease prevention campaigns. The statistics of the Industrial insurance companies, on the other hand, do not suffer from this disadvantage, applying as they do to a specific group. They point decidedly to the opportunities for the improvement of life and health conditions among the wage-working population of the United States and Canada.

The companies contributing the information to this study are: Colonial Life Insurance Company of America, John Hancock Mutual Life Insurance Company, Life Insurance Company of Virginia, Prudential Insurance Company of America and the Metropolitan Life Insurance Company. Together, these five companies in 1920 had an active, or premium-paying, membership in their Industrial departments of 26,000,000 men, women and children, or not far from one-quarter of the entire population of the United States and Canada. If we were further to compare this large number of insured persons with the working population found in the cities of the United States and Canada the proportion would be much higher. It is quite possible that three out of every four men, women and children above one year of age in the wage-working families in the cities of the United States and Canada are included in this survey. In order to stabilize even further the results of this investigation the companies have contributed their records for a period of five years, 1916 to 1920. In this way an experience of close to 115,000,000 years of life was obtained. Nowhere is there available for recent years so

detailed a collection of facts on life and health, and for so large a number of people, in one level of a population.

(b) Age and Sex Constitution of the Insured Group

As to sex and age constitution of the insured group, according to the facts available for one of the largest of the companies, about 46 per cent. are males and 54 per cent. are females. These ratios hold, practically, for all of the companies. The statistics are not shown separately for the sexes because not all of the companies had their exposures to risk classified on that basis. The males are representative of nearly every occupation in American and Canadian industry. Since weekly premium insurance is practically whole-family insurance, a heavy proportion of the policyholders are children. In the present study 35 per cent. of the group were children between one and fifteen years of age. The companies did not insure children under one year of age during the period covered by this report. The following table shows the age characteristics of the present experience compared with that of the general population of the United States Registration Area:

TABLE 1.

Percentage of Persons in Specified Age Periods Intercompany Industrial Mortality Experience (1916 to 1920) and United States Registration States, 1920

AGE GROUP	PERCENTAGE IN SPECIFIED AGE PERIOD	
	Intercompany Industrial 1916 to 1920	U. S. Reg. States, 1920
All ages—one and over	100.0	100.0
1 to 4	9.2	8.8
5 to 9	13.8	10.6
10 to 14	12.0	9.9
15 to 19	10.5	8.8
20 to 24	10.0	8.8
25 to 34	16.4	16.8
35 to 44	11.4	14.0
45 to 54	8.5	10.5
55 to 64	5.6	6.6
65 to 74	2.2	3.5
75 and over	.5	1.5

In general, there was a heavier representation of persons under 20 years of age in the group of insured wage-earners (46 per cent.) than in the population of the United States Registration States (38 per cent.).

The mortality experience is shown only for white lives because no distinction of color was maintained in the data on the lives exposed to risk in all of the companies. Color classification was available only for the Metropolitan and the Life Insurance Company of Virginia groups, and a classification by sex and by color only for the Metropolitan. The exposure to risk for each of the companies for the five year period 1916 to 1920 is shown in the following table:

TABLE 2.

Number of Years of Life Exposed to Risk in Industrial Experience of Each Company on Premium-paying White Business, 1916 to 1920

COMPANY	Number of Years of Life Exposed	Per cent. of Total
Combined experience.....	114,674,538	100.0
Metropolitan (white lives).....	51,249,713	44.7
Prudential (total)*	48,874,466	42.6
John Hancock (total).....	10,922,430	9.5
Life Ins. Co. of Virginia (white lives)..	2,489,998	2.2
Colonial (total)	1,137,931	1.0

* Prudential experience 99.9 per cent white lives.

(c) General Mortality Data of the Investigation

The record of these five years relates to 1,335,857 deaths, which occurred at the rate of 11.65 per 1,000 lives exposed. There were two dominant facts in the loss experience of the five year period—the first was the tremendous onslaught of influenza, which practically doubled the death rate of the year 1918 and continued to exact an excessive toll of lives well into 1919, and the second the losses from battle casualties among American and Canadian soldiers insured with the companies. Both losses were heavily concentrated in the year 1918. A favorable counteracting tendency was the precipitate fall in the tuberculosis death rate and the marked downward acceleration of the rates for heart, kidney and vascular diseases, especially in the years 1919 and 1920. If the year 1918 is excluded from the calculations, a sharp downward trend of mortality can be detected during the five year period.

Another calculation shows that if the death rate of these policyholders in 1916 had prevailed in 1920, there would have been 42,952 more deaths than were actually experienced in the latter year. And

this splendid showing was made in a year in which there was in the early months a sharp recrudescence of influenza! The facts for each year, 1916 to 1920, are shown in the following table.

TABLE 3

Death Rates per 1,000 by Single Calendar Years, 1916 to 1920. Intercompany Industrial Mortality Experience (Ages One Year and Over) and United States Expanding Registration Area (Ages One to Seventy-four)

YEAR	Intercompany Indl. Mortality Experience Ages one & over	U. S. Reg., Area—Ages One to Seventy-four years	Per cent. Intercompany Ind'l. of U. S. Reg. Area
1916 to 1920†	11.65	10.62†	110
1920	9.95	9.36†	106
1919	10.32	9.50	109
1918	15.48	13.96	111
1917	11.18	10.27	109
1916	11.61	10.06	115
Uniform annual decrement 1916 to 1920*	.418	.217	208
Per cent. decline 1920 since 1916	14.3	7.0	....

* Excluding year 1918 for both insured wage-earners' and general population series.
† Data for 1920 relate to U. S. Registration States; for years 1916 to 1919, U. S. Registration Area.

In the foregoing table, which is a comparison of insured wage-earners' mortality with the experience of the United States Registration Area, the facts for the latter group are confined to the age division one to seventy-four years. No infants under one year of age were insured by the Industrial companies, and there are comparatively few policyholders above age seventy-five. A proper comparison can be made, therefore, between the total mortality experience of the Industrial companies and that of the general population, if the data for ages above seventy-five and under one year are eliminated from the statistics of the Registration Area.

(d) Relatively Greater Fall of Mortality Rates among Insured Wage-Earners

There has been a greater fall in mortality among these Industrial policyholders than in the general population of the United States. ‡

‡ No data were available for the general population of the Dominion of Canada as a whole, so the comparison must be made with the facts of the United States Registration Area.

In fact, when the underlying trend of the mortality rates in the two groups is measured, the downward tendency (excluding 1918) is about twice as great (.418 deaths per 1,000 per year) as in the United States Registration Area (.217 deaths per 1,000 per year). Or this can be put in another way. In 1916 the mortality of the insured was 15% higher than that of the general population; in 1920 it was only 6% higher.

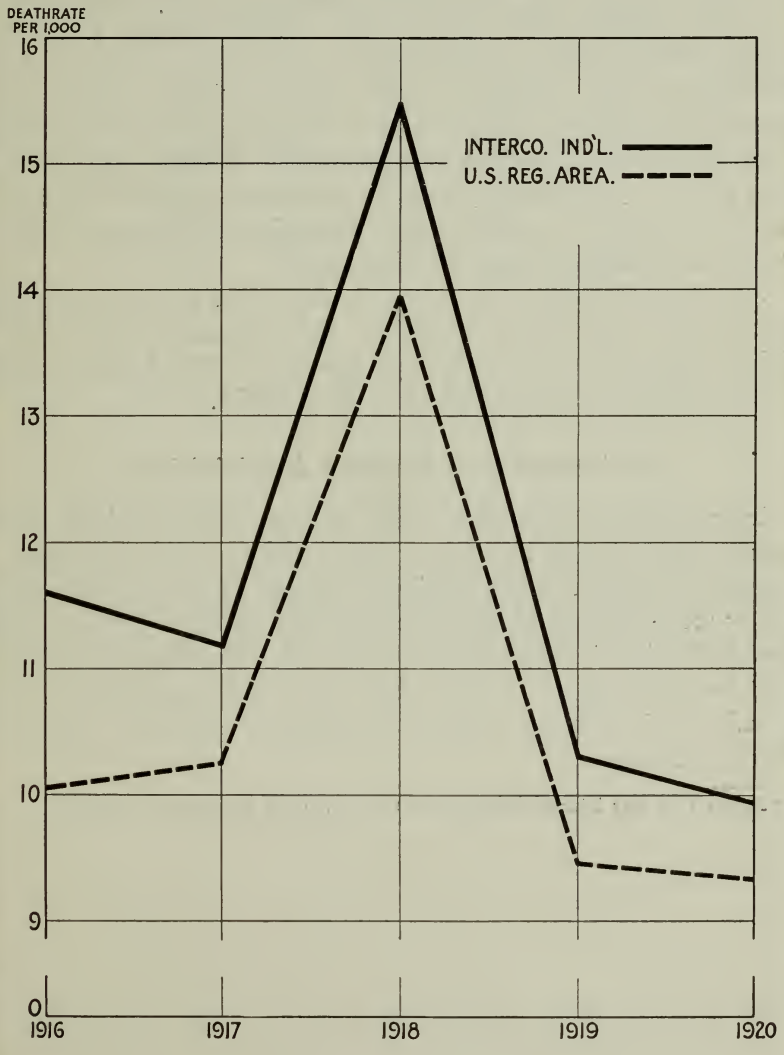
This greater downward acceleration in the death rate of insured wage-earners and of members of their families results from the operation of several powerful ameliorative factors. First, there was the marked improvement in the general well-being of wage-workers as a result of better wage and living conditions during and immediately after the war; second, the cumulative effect of several decades of health work, most of it directed at the improvement of housing, hygienic and other situations affecting directly the wage-working group of the population; third, the intensive health work of one of the companies, which includes bedside nursing of the sick, education of policyholders in hygiene and practical cooperation with health officials in securing health protective measures, coupled with the generally enlightened policy of all the companies in furthering health activities. The chief elements of the declining mortality during the five year period, excluding 1918 of course, have been the lower death rates for tuberculosis, heart disease, chronic nephritis, typhoid fever and a few other diseases of less importance numerically. Detailed comment on the individual causes of death will be made in succeeding sections of this report. The following chart illustrates the figures in Table 3.

CHART I.

All Causes of Death Combined.

Deathrate per 1,000: 1916 to 1920.

Intercompany Ind'l Mortality Experience & U.S. Reg. Area (ages 1 to 74 years) Compared



The prevalence of pandemic influenza in the latter part of 1918 and the early part of 1919 was the one exceptionally unfavorable element in the health record of the five year period, 1916 to 1920. The first "wave" of influenza appeared in March and April, 1918, and was marked in a few areas by the incidence of the suffocative, massive bronchopneumonia which was so destructive a complicating element of the ubiquitous "influenza" later on in the year. The spring invasion caused an appreciable rise in mortality rates; the fall and winter invasion was catastrophic in its effects. It is estimated that among these Industrial policyholders there died during the period 1918 to 1920 not less than 134,000 persons as a result of the influenza and its complications. A rise in mortality from other diseases and conditions, chiefly heart and kidney diseases, was expected in 1919 and 1920 because it was thought that the influenza might have caused marked impairments of cardiac, vascular and renal tissue. But apparently this did not occur, whatever may have been the cause. A more detailed discussion of influenza will be given in an ensuing section of this report.

Another adverse element in the record of the quinquennium was the mortality from battle casualties. For the period under review, 20,202 deaths from this cause were reported.* The largest number of these deaths was reported in 1918 (10,640).

(e) Mortality at Specified Age Divisions

Improvement in mortality rates between 1916 and 1920 at the several age divisions was very uneven indeed. The explosion of influenza in 1918 effected marked increases in the total mortality rates under 45 years of age, but had little effect beyond that age. Combined with the influenza loss there was considerable mortality from battle casualties. In the table on the following page we show the effect of influenza and war casualties, combined, upon the several age ranges.

* Deaths from war injuries estimated for two of the five cooperating companies.

TABLE 4

Percentage increase in death rate at specified age divisions 1918 over 1917

Intercompany Industrial Mortality Experience and U. S. Registration Area Compared

Age Period	Intercompany Industrial			U. S. Reg. Area—Ages 1 to 74		
	Death Rate per 1,000		Per cent. increase 1918 over 1917	Death Rate per 1,000		Per cent. increase 1918 over 1917
	1918	1917		1918	1917	
All ages—one and over.	15.48	11.18	38.5	13.96	10.27	35.9
1 to 4.....	16.29	11.71	39.1	16.74	11.76	42.3
5 to 9.....	4.67	3.27	42.8	4.96	3.27	51.7
10 to 14.....	3.75	2.32	61.6	4.04	2.37	70.5
15 to 19.....	8.57	4.12	108.0	7.08	3.62	95.6
20 to 24.....	15.15	5.88	157.7	9.99	5.10	95.9
25 to 34.....	18.64	7.59	145.6	14.52	6.47	124.4
35 to 44.....	15.44	11.73	31.6	13.48	9.25	45.7
45 to 54.....	19.34	18.80	2.9	16.20	14.91	8.7
55 to 64.....	33.58	33.56	.1	29.16	29.44	1.0*
65 to 74.....	71.24	69.72	2.2	56.27	58.34	3.5*

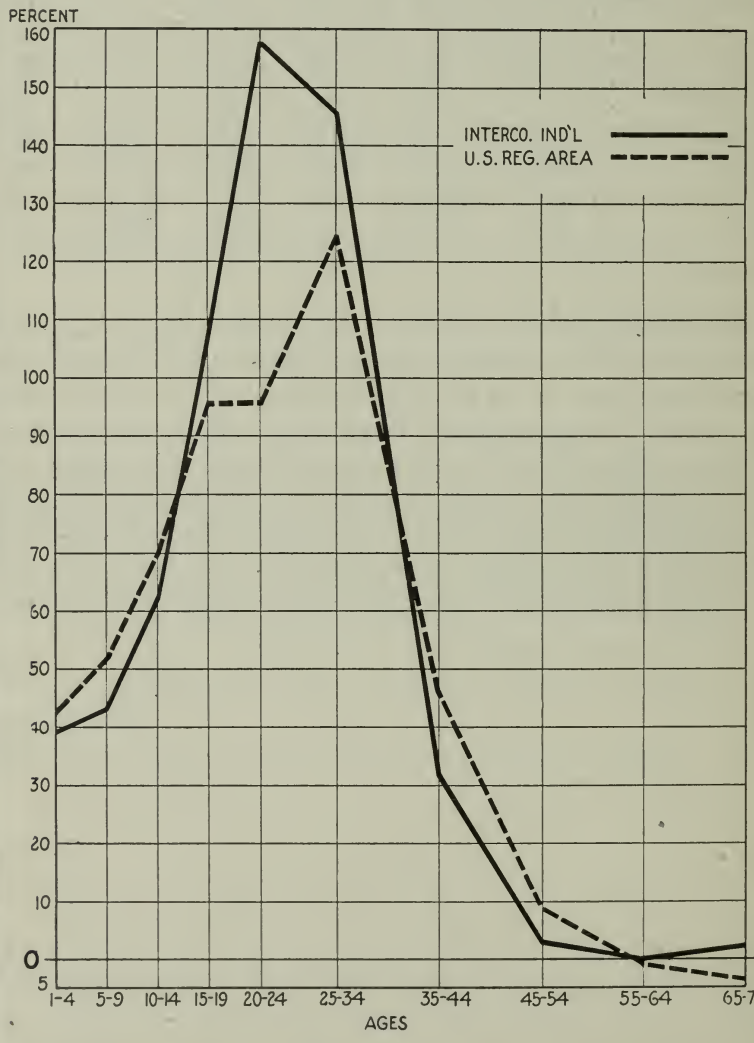
* Decrease.

The adverse forces in operation during 1918 produced a greater deformation in the mortality curve according to ages among insured wage-earners than in the general population of the United States. The maximum relative effect (158 per cent. excess) was produced at the age division 20 to 24 years among insured wage-earners and at 25 to 34 years (124 per cent. increase) in the general population. The following chart represents the percentage departure of the death rates of 1918 from those for 1917 at significant age periods for both the insured group and for the United States Registration Area.

CHART II.

Percentage Departures of 1918 from 1917 Deathrates, by Age Periods.

Intercompany Industrial Experience and U.S.Reg. Area Compared



This graph shows a heavier mortality toll among children under 15 years of age and among persons 35 to 54 years of age in the general population than among insured wage-earners. Beyond 55 years, influenza did not affect materially either the insured or the general population group. The foregoing table and graph should be interpreted, however, with the following fact in mind: during the war a large proportion of the young men, both in the insured group and in the general population, were in military service either at home or abroad. The insurance records show the deaths of all soldiers, both in Europe and in the United States, whereas the general population figures included only the deaths in the camps and cantonments in the United States. This may account for some of the excess in the percentages of increased mortality among insured wage-earners over the relative mortality figures of the general population.

The influenza pandemic produced enormously higher death rates from influenza and pneumonia; but, during the period of epidemic prevalence there was a temporary rise also in the death rates for tuberculosis, heart disease, accidents of pregnancy and accidents of labor. This, also, tended toward increase in the total mortality at the young adult ages during the height of the epidemic.

The exceptionally favorable mortality rates prevailing at the ages beyond 45 years during 1919, 1920 and 1921 have occasioned comment that perhaps the influenza of 1918 had caused the deaths of many organically impaired lives who would, under ordinary conditions, have died in subsequent years. The following two tables, one for insured wage-earners and the other for the general population, show that no such extraordinary mortality occurred among impaired lives at the advanced ages during 1918, and that the favorable record of the years 1919 and 1920 will have to be ascribed to the marked improvement in conditions regulating the general well-being of the population and to the cumulative effect of sanitary and other work in hygiene during the past two decades.

TABLE 5

Death Rates per 1,000 at Specified Age Periods, Each Calendar Year, and Combined Period, 1916 to 1920 Intercompany Industrial Mortality Experience

AGE PERIOD	Period 1916 to 1920	1920	1919	1918	1917	1916	Per Cent Decline or Increase; 1920 Since 1916
All ages—one & over	11.65	9.95	10.32	15.48	11.18	11.61	—14.3
1 to 4	12.05	10.05	9.50	16.29	11.71	13.29	—24.4
5 to 9	3.56	3.14	3.26	4.67	3.27	3.50	—10.3
10 to 14	2.59	2.26	2.38	3.75	2.32	2.24	+ .9
15 to 19	4.95	3.89	4.47	8.57	4.12	3.72	+ 4.6
20 to 24	8.01	5.59	7.70	15.15	5.88	5.61	— .4
25 to 34	10.06	7.13	9.44	18.64	7.59	7.44	— 4.2
35 to 44	11.60	9.11	10.32	15.44	11.73	11.88	—23.3
45 to 54	17.01	14.28	15.12	19.34	18.80	18.32	—22.1
55 to 64	31.18	28.34	28.09	33.58	33.56	33.13	—14.5
65 to 74	67.74	65.10	62.84	71.24	69.72	70.42	— 7.6
75 and over	159.45	194.10	133.85	141.69	136.97	180.83	+ 7.3

TABLE 6

Death Rate per 1,000 at Specified Age Periods, Each Calendar Year, and Combined Period, 1916 to 1920.* United States Registration Area.*

AGE PERIOD	Period 1916 to 1920*	1920*	1919	1918	1917	1916	Per Cent. Decline or Increase; 1920 Since 1916
All ages—one to 74.	10.62	9.36	9.50	13.96	10.27	10.06	— 7.0
1 to 4	11.89	9.74	9.71	16.74	11.76	11.80	—17.5
5 to 9	3.51	2.96	3.31	4.96	3.27	3.07	— 3.6
10 to 14	2.69	2.28	2.54	4.04	2.37	2.17	+ 5.1
15 to 19	4.50	4.08	4.07	7.08	3.62	3.46	+17.9
20 to 24	6.29	5.70	5.45	9.99	5.10	4.97	+14.7
25 to 34	8.31	6.82	7.15	14.52	6.47	6.25	+ 9.1
35 to 44	9.71	8.18	8.62	13.48	9.25	9.04	— 9.5
45 to 54	14.06	12.06	12.93	16.20	14.91	14.60	—17.4
55 to 64	27.05	23.59	25.24	29.16	29.44	28.91	—18.4
65 to 74	54.85	52.19	50.60	56.27	58.34	57.93	— 9.9

*Data for 1920 relate to U. S. Registration States; for years 1916 to 1919, to U. S. Registration Area.

In closing this comment on the age characteristics of the total mortality, it may be well to direct attention to the remarkable showing of the group of insured wage earners in the year 1920. Among the general population, the recrudescence of influenza in January and February caused increases in the death rates between ages 10 and 34 years, ranging from 5 to 18 per cent. above the figures for the year 1916. In the insured group, mortality had so far declined since 1916 that the recrudescence affected only the two age groups between 10 and 19 years, and only for the period 15 to 19 years was there a disturbance of as much as 5 per cent. above the 1916 figures. The 7.3 per cent. increase above 75 years is of no significance because of the small number of lives exposed and the uncertain age make-up of this group in advanced life.

II. PRINCIPAL CAUSES OF DEATH

Conclusions only of the most general nature can be drawn from the data given in the introductory section of this report. The chief lessons for the public health movement, from the materials available in this study, lie in the facts for the principal diseases and conditions. Public health work proceeds by stating and operating a programme for the suppression of a particular disease or condition. The results of such a programme must be tested by appeal to the comparative and historical facts for the disease or condition. The present collection of data offers the facts for both insured wage-earners and for the general population of the United States, by broad age divisions and with respect to a number of important diseases and conditions.

The accuracy of statistics of causes of death, and the comparability of the facts for different groups at various times, depend upon two important factors: *first,* upon registration and certification conditions,—the diagnostic ability of physicians, the local customs of physicians in the use of names of the several diseases and conditions, and the care with which the causes of death are reported upon death certificates; *second,* upon classification and tabulation procedure,—the office methods used in classifying causes of death, the fidelity with which certificates are scrutinized for inconsistent, improbable and impossible returns from the doctors, and the extent to which effort is made to secure correction of these obviously defective returns.

It is believed that the original records of diseases and conditions upon the companies' death certificates were of somewhat better quality than those usually submitted to official registration offices. More of the history of past illness is given, often there are supplementary statements from claimants, from other physicians previously attending the deceased, newspaper clippings with respect to accidents and other injuries, etc. Each of the companies made it a matter of consistent practice throughout the period of this study to query physicians with respect to vague, indefinite and otherwise unsatisfactory returns of the causes of death. For example, one of the companies received, in one year, 6,200 letters from physicians correcting or substantiating statements of causes of death. In the whole of that year 118,000 deaths occurred in the Industrial Department of that company. It will readily be seen that the accuracy of the statistics offered in this report would have been seriously impaired if the companies had taken the certificates at their face value and had not endeavored to improve the quality of the raw material.

Furthermore, the same plan of classification of causes of death for purposes of these statistics was pursued by the several companies. The statements found upon death certificates, or as afterward obtained from physicians, were classified under the rubrics of the *International Classification of Causes of Sickness and Death,* 1909 edition.* This insured uniformity throughout in the office practice of the companies in classing the causes of death.

Another important procedure was employed. The *Index of Joint Causes of Death*† issued by the Division of Vital Statistics, Bureau of the Census, was used in allocating under categories of the International List those returns where two or more diseases or conditions were stated as contributing to the death of policyholders. There are certain fixed principles involved in the treatment of jointly returned statements of causes of death; for some statements, classification can be accomplished by adherence to these principles. But in many other instances no fixed rules apply. The *Index of Joint Causes of Death* records the practice of the Division of Vital Statistics of the Bureau of the Census in past years with regard to these special cases, and only by adherence to the decisions made in the past by that Office can any comparability be maintained between the cause of death statistics compiled by the Census Bureau and by the life insurance companies. Furthermore, it is necessary to keep in touch with current developments in this important branch of practical vital statistics. In the nature of things, new situations continue to arise and must be handled alike by the several private and official bureaus which compile and publish statistics of mortality from disease. Certainly no statistics of mortality can be said to be worthy of notice until the returns for causes of death are put through expert, uniform, classification procedure. The best sort of material from the doctors can be hopelessly garbled by amateur effort in classification practice.

The following table shows the death rates per 100,000 from principal causes of deaths in 1916 and 1920 in this mortality experience, with comparative data for the United States Registration Area at ages one to seventy-four years. In the succeeding chapters, the details for each of the important causes of death are brought out, with respect to the single calendar years and for broad age periods.

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* Manual of the International List of Causes of Death, based on the Second Decennial Revision by the International Commission, Paris, July 1 to 3, 1909. Government Printing Office, Washington, D. C., 1911.

† Government Printing Office, Washington, D. C., 1914.

In this table the selected causes of death are shown according to the numerical importance of the death rates.

TABLE 7

Death Rates per 100,000 from Principal Diseases and Conditions, 1916 to 1920.
Intercompany Industrial Mortality Experience and U. S. Registration Area (Ages one to 74 Years) Compared

CAUSE OF DEATH	INTERCOMPANY INDUSTRIAL				U. S. REG. AREA (1 to 74yrs.)			
	1916–1920	1920	1916	Per cent. Decline 1916–1920	1916–1920	1920	1916	Per cent. Decline 1916–1920
All Causes of Death—Total	1164.9	994.5	1160.9	14.3	1062.2	935.7	1005.5	6.9
Influenza-pneumonia	243.3	158.3	138.3	†14.5	218.4	161.2	110.2	†46.3
Influenza	111.5	56.7	22.9	†147.6	93.1	61.6	15.3	†302.6
Pneumonia	131.8	101.6	115.4	12.0	125.2	99.6	94.9	†5.0
Tuberculosis—All forms	154.5	124.9	170.2	26.6	133.9	112.5	141.1	20.3
Tuberculosis of the lungs	139.9	113.1	153.1	26.1	119.7	100.4	125.2	19.8
Organic dis. of the heart	127.5	123.6	141.5	12.7	108.3	101.8	113.2	10.1
Bright's disease	84.0	74.5	100.7	26.0	70.0	61.8	77.9	20.7
Accidents—Total	73.2	65.4	76.8	14.8	71.3	63.7	76.7	16.9
Traumatism by fall	10.8	9.5	13.6	30.1	8.6	7.1	10.7	33.6
Automobile accidents	10.5	12.1	8.1	†49.4	9.0	10.2	7.3	†39.7
Accidental drowning	8.6	6.7	9.7	30.9	7.1	5.8	8.7	33.3
Burns(conflagration ex.)	8.5	7.8	8.7	10.3	7.5	7.0	7.5	6.7
Railroad accidents	7.7	6.0	8.6	30.2	9.4	7.3	11.4	36.0
Other accidents	27.1	23.3	28.1	17.1	29.7	26.3	31.1	15.4
Cancer—All forms	72.0	75.0	74.2	†1.1	71.9	72.7	72.8	.1
Cerebral hemor.; apoplexy	62.8	63.5	69.3	8.4	56.8	55.9	58.2	4.0
Diphtheria and croup	22.9	23.0	21.8	†5.5	14.3	14.8	13.7	†8.0
Diarrhea and enteritis	21.2	16.0	26.9	40.5	23.1	17.4	26.4	34.1
Puerperal state—Total	20.0	21.8	16.8	†29.8	19.0	19.6	16.9	†16.0
Puerperal septicemia	6.6	7.5	6.7	†11.9	6.7	6.8	7.0	2.9
Puerp. album. & conv	4.7	5.0	4.6	†8.7	4.6	4.9	4.5	†8.9
Accidents of pregnancy	3.1	2.9	1.5	†93.3	2.8	2.8	1.4	†100.0
Diseases of the arteries	15.6	15.6	17.3	9.8	10.9	10.1	11.4	11.4
Diabetes	15.4	15.3	17.0	10.0	14.8	14.8	15.7	5.7
Appendicitis	11.2	12.4	11.6	†6.9	12.5	13.4	13.1	†2.3
Cirrhosis of the liver	10.1	6.3	14.9	57.7	8.5	6.2	11.4	45.6
Suicides—Total	8.9	7.3	11.0	33.6	12.0	10.1	14.2	28.9
Typhoid fever	8.3	5.7	11.2	49.1	11.3	7.8	13.6	42.6
Measles	7.9	8.4	10.2	17.6	7.4	7.0	8.6	18.6
Whooping cough	5.4	5.8	5.0	†16.0	5.4	5.8	4.8	†20.8
Scarlet fever	5.0	6.2	4.3	†44.2	3.5	4.6	3.2	†43.8
Homicides—Total	3.6	3.4	3.8	10.5	7.1	6.7	7.0	4.3
Pellagra*	3.2	2.0	3.5	42.9	3.6	2.4	3.3	27.3
Acute ant. poliomyelitis	3.2	.8	14.1	94.3	2.4	.8	8.8	90.9
Cerebrospinal fever	1.5	.8	1.1	27.3	2.0	1.3	1.7	23.5
Malaria	.8	.7	1.1	36.4	2.9	2.9	2.6	†11.5
War deaths	17.6	.7	8.9	92.1	.....	.....	.....	.....

*For Met. L. I. Co. and L. I. Co. of Va. only.
†Increase.

III. TUBERCULOSIS

Tuberculosis was the leading cause of death among the Industrial policyholders of the five companies cooperating in this study, unless we consider the joint mortality from influenza and pneumonia as due to one disease.

This disease caused 177,138 deaths during the period 1916 to 1920, and the death rate was 154.5 per 100,000 policyholders. This may

be compared with the following rates for the other causes of chief numerical importance in this experience:

Tuberculosis—all forms	154.5
Tuberculosis of the lungs	139.9
Pneumonia	131.8
Organic heart disease	127.5
Influenza	111.5
Bright's disease	84.0
Accidents	73.2
Cancer—all forms	72.0
Cerebral hemorrhage	62.8

Thirteen and three-tenths per cent. of the total mortality among these insured wage-earners and their families was due to tuberculous disease, or one out of every seven and one-half deaths. In addition to ranking as the leading cause of death at all ages, it stood first at the following age periods, 15 to 19, 20 to 24, 25 to 34, 35 to 44 and 45 to 54 years. At ages one to four, it was seventh in numerical importance to pneumonia, diarrheal diseases, influenza, diphtheria, accidents and measles which ranked in the order named. At ages five to nine, tuberculosis was fifth in importance, its mortality being exceeded by diphtheria, accidents, influenza and pneumonia. In the next highest age group, ten to fourteen years, accidents were the chief cause of death and, together with influenza, were the only causes whose death rates were higher than that for tuberculosis. After age fifty-five, tuberculosis was still one of the important causes. In the age group 55 to 64, it stood sixth. The diseases with higher rates were heart disease, cancer, Bright's disease, cerebral hemorrhage and pneumonia. In the age period 65 to 74 years, it ranked ninth in importance. While not among the chief causes of death after 75, it is interesting to note that tuberculosis caused nearly one per cent. of the total mortality in the highest age group. In normal years, the tuberculosis death rate far exceeds that of influenza at all age periods.

The following table shows the number of deaths from tuberculosis and the death rates per 100,000 policyholders of the five cooperating companies, for all ages combined, and for each age group during the five-year period 1916 to 1920.

TABLE 8

Deaths and Death Rates per 100,000 from Tuberculosis Intercompany Industrial Mortality Experience, 1916 to 1920 By Age Periods

Age Periods	Death Rates per 100,000		Number of Deaths	
	Tuberc.—all forms	Tuberc. of lungs	Tuberc.—all forms	Tuberc. of lungs
All ages—one and over	154.5	139.9	177,138	160,403
1 to 4	62.0	16.3	6,510	1,710
5 to 9	22.3	8.2	3,518	1,298
10 to 14	27.1	18.9	3,733	2,600
15 to 19	125.4	115.2	15,091	13,862
20 to 24	218.5	207.7	25,074	23,845
25 to 34	249.3	238.7	46,821	44,834
35 to 44	271.7	259.0	35,665	34,007
45 to 54	235.6	222.9	22,887	21,661
55 to 64	196.4	183.5	12,538	11,714
65 to 74	174.4	160.6	4,470	4,116
75 and over	152.3	138.5	831	756

The tuberculosis death rate attained its maximum (271.7 per 100,000) at ages 35 to 44 years; its next highest rate was for the age group 25 to 34 years (249.3); its third highest figure (235.6) was for ages 45 to 54 years; and its fourth highest rate (218.5 per 100,000) at 20 to 24 years. The death rates recorded in the foregoing table emphasize the fact that tuberculous disease is an important cause of death at every period of life, although its toll is greatest at those ages at which a human life is of the greatest value to the community and at which the deaths are, to a very large extent, those of the heads of families, the loss of whom works the greatest hardship upon those dependent upon them.

The facts for the death rates from tuberculosis of the lungs are shown comparatively with those for tuberculosis—all forms, in the preceding table. This form of the disease accounts for 91 per cent. of the total tuberculosis deaths. The maximum death rate, here also, was observed at the age groups 35 to 44 years, with the values descending on both sides of the maximum. It should be observed that among children under 10 years of age, the death rates for other forms of tuberculosis are higher than that for the pulmonary form. Tuberculous meningitis is the chief form of the disease at these early ages. Beginning with early adolescence, however, pulmonary tuberculosis is the more important, the dominating form, of the disease.

Tuberculosis is, and has been, a grave source of economic loss; it has been estimated that the loss in life expectancy by reason of tuberculosis amounts to about three and one-half years for white males, and five years for colored males. For white females, the loss is approximately two and one-half years and for colored females, five years. If a year of life is worth one hundred dollars in net addition to the national wealth, these inroads of tuberculosis represent a loss of, possibly, a half billion of dollars a year in the United States. This calculation does not include the huge loss arising out of the extended disability of persons afflicted with the disease, nor does it include the cost of medical care, nursing or relief.

Comparison of Tuberculosis Death Rates by Age Among Insured Wage Earners and in the General Population

The foregoing age statistics of tuberculosis may be supplemented by a comparison with the facts for the United States Registration Area. It should be borne in mind that these wage-earners reside almost exclusively in cities of the United States and Canada and that 51 per cent. of the population of the United States Registration Area lives in rural communities; that is, incorporated places containing less than 10,000 inhabitants, or in strictly rural communities not under municipal forms of government. This factor bears heavily on comparisons between the experience of the insured group and that of the general population. The following table shows the tuberculosis death rates prevailing in the two groups for the period 1916 to 1920.

TABLE 9

Death rates per 100,000 from Tuberculosis Intercompany Industrial Mortality Experience and U. S. Registration Area Compared By Age Periods. 1916 to 1920.

Age Period	Tuberculosis—All Forms			Tuberculosis of the Lungs		
	Interco. Ind'l	U.S.Reg. Area	Per cent. Interco. Ind'l of U.S.Reg. Area	Interco. Ind'l	U.S.Reg. Area	Per cent. Interco. Ind'l of U.S.Reg. Area
All ages—one and over*	154.5	133.9	115.4	139.9	119.7	116.9
1 to 4	62.0	61.1	101.5	16.3	20.2	80.7
5 to 9	22.3	24.4	91.4	8.2	10.8	75.9
10 to 14	27.1	32.0	84.7	18.9	23.2	81.5
15 to 19	125.4	106.7	117.5	115.2	96.6	119.3
20 to 24	218.5	178.1	122.7	207.7	166.3	124.9
25 to 34	249.3	191.4	130.3	238.7	180.1	132.5
35 to 44	271.7	182.1	149.2	259.0	171.0	151.5
45 to 54	235.6	169.2	139.2	222.9	157.5	141.5
55 to 64	196.4	176.5	111.3	183.5	161.7	113.5
65 to 74	174.4	182.1	95.8	160.6	164.2	97.8

* Ages 1 to 74 years for U. S. Reg. Area.

The death rates among insured wage-earners were 15 per cent. in excess of those for the general population of the United States Registration Area for all forms of tuberculosis and 17 per cent. in excess for pulmonary tuberculosis. This disparity between the tuberculosis experience of the two groups varies with age. In order to deal with a definite disease entity, let us confine our attention to the comparative facts for tuberculosis of the lungs.

For this disease, among children under fifteen years of age, the death rate was less among the insured group than in the general population! At the age division 15 to 19 years, however, insured wage-earners in cities show an excess of 19 per cent. This measure of excess rises with advancing age, reaching its maximum at the age division 35 to 44 years (52 per cent.) and declining thereafter. Where insured wage-earners show the greatest excess over the rates of the general population, the maximum death rate in any age period prevails. It should be remembered, though, that fundamental changes are taking place in the tuberculosis situation; that the rates are falling much faster among insured wage-earners than in the general population and that in a very few years, at the present rate of progress, the rates may coincide. Observe the graphic chart on

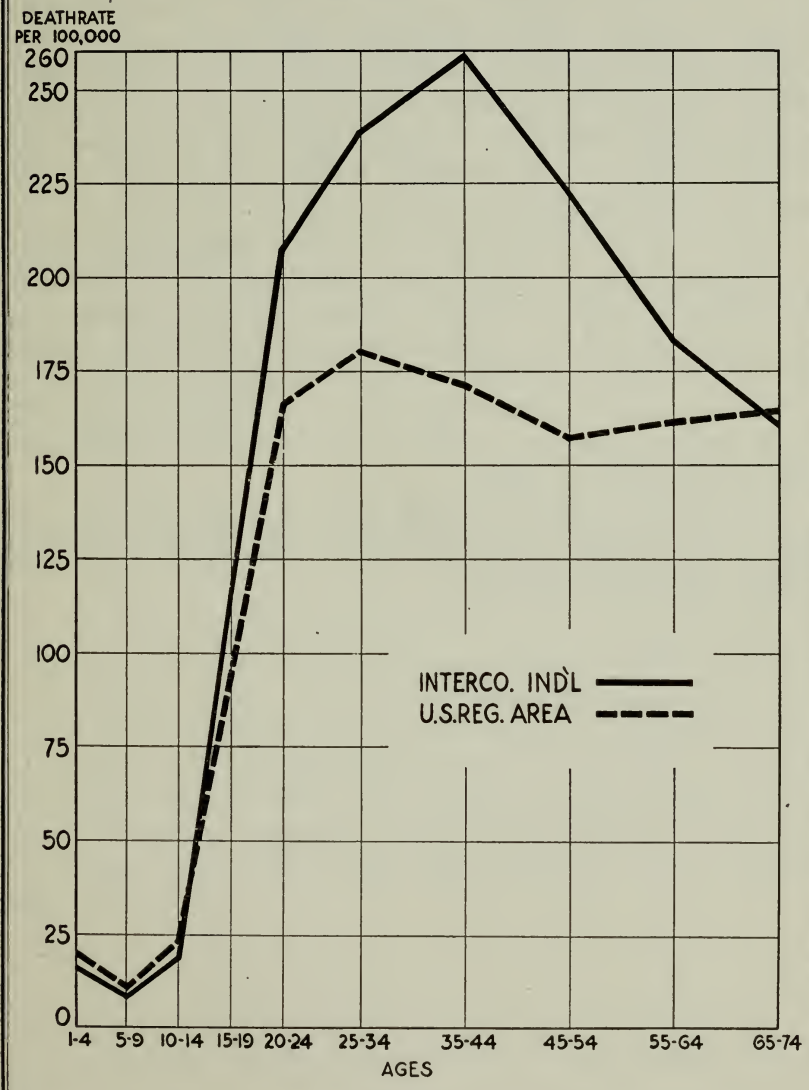
page 23 for the period 1916 to 1920; the tuberculosis death rate of the insured group was sharply peaked, the maximum being at the age period 35 to 44 years; in the general population, there is a slight peak at this age division, with a halting, horizontal tendency of the line after that age. In the experience of one of the companies for the year 1921, the contour of the curve by age resembles very much that for the United States Registration Area for the period 1916 to 1920. In 1916, in the experience of that company, there was, to be sure, a peak at the age division 35 to 44 years; but, within a few years, the tuberculosis death rate had so far declined that the sharp peak of five years ago was flattened, and the same characteristics observed for the general population in the accompanying chart were found to exist in 1921 among the insured wage-earners. This shows how thoroughly effective tuberculosis control work has been. The wage working group of the population is benefiting more from this beneficent activity than the whole of the population, as is witnessed by the more rapidly declining death rate.

CHART III.

Tuberculosis of the Lungs.

Deathrate per 100,000 at specified age periods, 1916 to 1920.

Intercompany Ind'l Mortality Experience & U.S.Reg. Area (ages 1 to 74 years) Compared



Declining Death Rate from Tuberculosis Among Insured Wage-Earners in Cities and in United States Registration Area, 1916 to 1920

Among insured wage-earners, there was a practically stationary death rate during the years 1916, 1917 and 1918. Beginning with 1919, and continuing throughout 1920, the death rate dropped precipitately. From figures for one of the companies, we learn that the decline continued with even greater velocity during 1921. In 1922, there was a still lower rate for this particular Company's policyholders. The fall of the tuberculosis death rate among insured wage-earners is one of the outstanding facts in the public health history of the twentieth century. Ten years ago, no such phenomenal drop in the death rate was anticipated. At the present time, tuberculosis bids fair to assume permanently the second or third place in the mortality lists.

Another fact in these records is of great significance; notwithstanding an *increase* of 28 per cent. in the number of lives under observation in this experience between 1916 and 1920, there was a decrease of 5.8 per cent. in the number of deaths! Another calculation will be of interest. If the 1916 death rate for tuberculosis had prevailed in 1920, 43,899 deaths would have occurred. The actual number recorded was 32,204, or a reduction of 11,695 deaths over the experience of 1916.

The tables on pages 25 and 26 show the deaths from and death rates for tuberculosis—all forms—and for tuberculosis of the lungs in each year of the experience.

TABLE 10

Deaths and Death Rates per 100,000 from Tuberculosis—All Forms.

Intercompany Industrial Mortality Experience and U. S. Registration Area (Ages 1 to 74 years), compared. 1916 to 1920.

Year	Death Rate per 100,000			Number of Deaths	
	Interco. Ind'l	U.S.Reg. Area	Per cent. Interco. of U.S. Reg. Area	Interco. Ind'l	U.S.Reg. Area
1916 to 1920	154.5	133.9	115.4	177,138	515,125
1920	124.9	112.5	111.0	32,204	93,342
1919	144.6	125.2	115.5	35,364	102,796
1918	169.7	148.6	114.2	38,838	116,601
1917	170.3	145.8	116.8	36,543	105,355
1916	170.2	141.1	120.6	34,189	97,031
Per cent. decline 1916 to 1920	26.6	20.3	....	.....	.....
Average fall of death rate per year, 1916 to 1920	11.6	7.8	....	.....	.....
Per cent. average fall of death rate for period, 1916-1920	7.5	5.8	....	.....	.....

The tendency of the tuberculosis death rate of insured wage-earners to approach that of the general population can be measured in two ways. The first is a comparison of the decline, year by year, in the ratio of the wage-earners' rate to that of the general population. In 1916, the tuberculosis death rate of the insured group was 21 per cent. above that of the general population; in 1920, it was only 11 per cent. in excess. Second, the average fall of the death rate throughout the quinquennium was 11.6 points per 100,000 per year as compared with 7.8 points for the general population. The gap between the curves of tuberculosis mortality of insured wage-earners and of the general population is being closed—and at a rapid rate. The facts for tuberculosis of the lungs are shown on the following page.

TABLE 11

Deaths and Death Rates per 100,000 from Tuberculosis of the Lungs

Intercompany Industrial Mortality Experience and United States Registration Area (Ages 1 to 74 years), compared. 1916 to 1920.

YEAR	DEATH RATE PER 100,000			NUMBER OF DEATHS	
	Interco. Ind'l	U.S.Reg. Area	Per cent. Interco. Ind'l. of U.S. Reg. Area	Interco. Ind'l of	U.S.Reg. Area
1916 to 1920.....	139.9	119.7	116.9	160,403	460,351
1920	113.1	100.4	112.6	29,166	83,277
1919	128.2	112.2	114.3	31,372	92,093
1918	155.3	133.6	116.2	35,524	104,794
1917	156.5	130.1	120.3	33,582	94,053
1916	153.1	125.2	122.3	30,759	86,134
Per cent. decline, 1916 to 1920	26.1	19.8	....	.....	.....
Average fall of death rate per year, 1916 to 1920...	10.8	6.8	....	.....	.....
Per cent. average fall of death rate for period, 1916 to 1920.....	7.7	5.6	....	.....	.....

So far as the characteristics of the fall in the death rate from tuberculosis of the lungs are concerned, the same general conclusions apply as for tuberculosis, all forms.

In connection with both tuberculosis—all forms, and tuberculosis of the lungs, the fall in the death rate after 1918 has been associated by some commentators with the onslaught of influenza. It has been suggested that since influenza took its heaviest toll at those ages where tuberculosis is most frequent, a large number of tuberculous persons died of influenza in 1918 who would have died from some form of tuberculosis in 1919 and 1920. This may be true to a certain extent. The evidence is confusing, however. Some observers of influenza have pointed out that, according to facts available to them, influenza was much less prevalent among the tuberculous than among the healthy adult population. If this contention is true, then there must have been a lower influenza prevalence and mortality rate among the tuberculous and consequently no significant loss in the number of such persons with the advanced form of the disease.

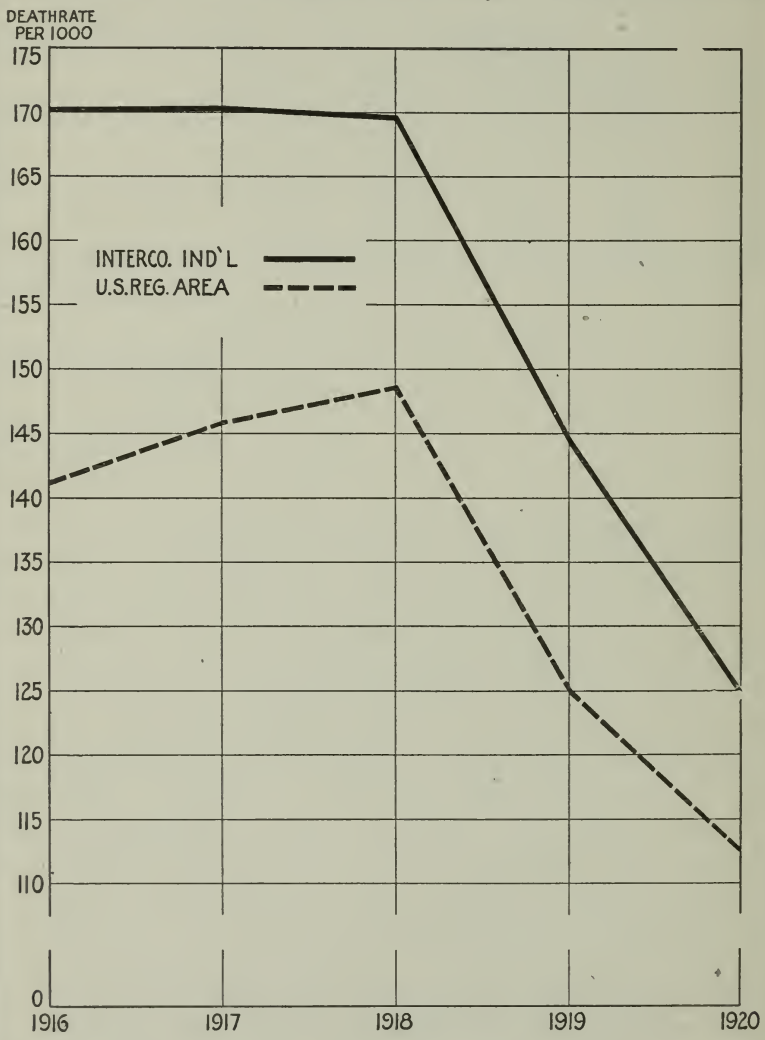
It should be noted, however, that during the height of the influenza pandemic, during the autumn of 1918, there was a significant rise in the tuberculosis death rate, but this was not profound enough to affect seriously the number of tuberculous persons whose deaths would have occurred in 1919 and 1920. The following graph shows the decline in the death rates for tuberculosis—all forms.

CHART IV.

Tuberculosis – all forms.

Deathrate per 100,000. 1916 to 1920.

Intercompany Ind'l Mortality Experience & U.S. Reg. Area (ages 1 to 74 years) Compared



IV. INFLUENZA

The outstanding feature of this report is its record of the mortality of wage-earners during the influenza pandemic of 1918-1919. Nowhere in the history of public health is there a record of so sudden, so severe, and so extensive a loss of life within a few months. The facts for these insured wage-earners are a part of the history of the influenza, world-wide in its extent, affecting populations living under practically all climatic, economic and social circumstances. Within a few months the influenza and its pneumonic complications destroyed more lives throughout the world than did four years of the Great War. Every level of the population was affected to an extraordinary extent by the influenza, but the heaviest blow seems to have fallen upon those groups of the population in more modest circumstances where facilities for early diagnosis and effective treatment were perhaps not so good as for the better circumstanced strata.

Death-toll of the Influenza of 1918-1919

In calculating the approximate death-toll of influenza, we must consider not only the number of deaths which were reported as having been due to influenza or to pneumonia probably or actually influenzal in origin, but also the deaths from other diseases and conditions where the prevailing influenza was a determining factor in causing death. To the estimates of mortality from influenza and from influenzal pneumonia, must first be added the many thousands of deaths which resulted from the interference of influenzal disease with the health, well-being, and safety of pregnant and parturient women. A second factor, for which, unfortunately, there are no data available in the present mortality experience of insured wage-earners, is the heavy mortality among infants born either prematurely or at full-term to women suffering with acute influenza or influenzal pneumonia. A third element to be considered is the effect of influenza upon persons suffering from moderately advanced, or advanced, stages of diseases of the heart, kidneys, or blood vessels. By some observers, it has been said that there was a considerable excess mortality, also, among the tuberculous population whose deaths were hastened by acute influenza. These supplementary factors in the mortality record of the pandemic are mentioned in what seems to be the order of their importance as elements of the death toll.

So far as this group of insured wage-earners is concerned, reliable estimates of the mortality from influenza and its pneumonic complications can be made. A fairly dependable approximation of the excess mortality from influenzal interference with pregnancy and with the mechanism of labor can also be made. No facts are available, however, on the destruction of infant life among the wage-working group of the population, because no data for infants under one year are to be found in these present records. Only a very rough approach can be made to the facts for the number of deaths among persons afflicted with diseases of the heart, blood vessels and kidneys, or among persons suffering from tuberculosis or other chronic ailments.

Only the approximate truth can be told about this catastrophe. The estimates as they stand are sufficiently reliable to convey some idea of the enormous loss of life at those ages where family responsibilities and potential usefulness are greatest. Among the policyholders insured in the companies contributing to this experience, it can be reliably estimated that in the three years, 1918 to 1920, there occurred 129,000 deaths from epidemic influenza or from influenzal pneumonia, over and above the number which would have occurred if the mortality rates of the year 1917 had prevailed. Approximately 101,000 of these deaths occurred in the year 1918, and a heavy proportion of this number was concentrated in the months of October and November of that year.

Influenza and its accompanying pneumonias were prevalent to an excessive degree among the American population from about September 15, 1918, to April 1, 1919. This period covered the principal epidemic wave of the disease. We estimate that for the whole period of this "wave" of influenza there died 123,000 wage-workers insured in the companies contributing to this experience. There had been, to be sure, a sharp outbreak during March and April, 1918, of a disease resembling in a few localities the influenza which prevailed later on in the year. Reliable records of illnesses in a number of commercial establishments show that there were, in fact, more cases of uncomplicated influenza, or common "grippe," during these two spring months than during the fall and winter months of 1918; but there were very few pneumonic complications, and consequently, a low mortality. The chief cause of the exceedingly heavy mortality during the fall and winter wave of the disease was the severe complicating pneumonia. After the cessation of the major wave of the disease in April, 1919, nothing more was heard of influenza and its

complicating pneumonias until January, 1920, when there was a recrudescence lasting about eight weeks and not occasioning, except in a few localities, anything like the enormous mortality figures recorded during the 1918-1919 wave. For the year 1920 we estimate that 8,000 of the policyholders in these five companies died from epidemic influenza or from influenzal pneumonia above the number expected under the experience of 1917. In making all of these estimates, we have made due allowance for an estimated number of about 30,000 deaths from influenza or pneumonia, each year 1918 to 1920, which would have occurred if the influenza pandemic had not prevailed.

To the number of 129,000 given above, we should add a further estimate of 3,455 deaths where influenza or its complications interfered with the normal progress of pregnancy and of labor. This brings the grand total of loss among these insured wage-earners from influenza and its complications in three years, 1918 to 1920, to 132,455.

It is, unfortunately, impossible to supplement this figure with any reliable estimate of the number of deaths occasioned by acute influenza complicating chronic organic diseases. The above estimate is a minimal one.

The following table shows the deaths and death rates from influenza and pneumonia, and for both of these causes of death combined, in each of the years 1916 to 1920.

TABLE 12

Deaths and Death Rates per 100,000 from Influenza and Pneumonia—all forms

Intercompany Industrial Mortality Experience, 1916 to 1920

Year	Death Rate per 100,000			Deaths		
	Influenza-pneumonia	Influenza	Pneumonia all forms	Influenza-pneumonia	Influenza	Pneumonia all forms
1916-1920	243.3	111.5	131.8	279,042	127,847	151,195
1920	158.3	56.7	101.6	40,829	14,630	26,199
1919	213.6	105.1	108.5	52,252	25,716	26,536
1918	570.4	350.6	219.8	130,501	80,211	50,290
1917	129.0	12.5	116.5	27,680	2,691	24,989
1916	138.3	22.9	115.4	27,780	4,599	23,181

Age Characteristics of Pandemic Influenza

Next in interest to the enormity of the loss from influenza and its complications, and the suddenness with which the number of deaths accumulated, are the age characteristics of the invasion.

In December, 1915, and January, 1916, there was an unusual prevalence of grippal disease complicated frequently by lobar pneumonia. This epidemic seemed to affect chiefly children and old people. This age distribution is characteristic also of the so-called endemic influenza and of the pneumonias which usually complicate it, as for instance, the facts for the year 1917. But, the invasion of the fall of 1918, and the recrudescence during eight weeks in the early part of 1920, was very decidedly concentrated in the young adult ages, with some excess in early childhood. In considering the following figures on the death rates for influenza and pneumonia combined, two facts should be borne in mind: First, the mortality ascribed to "influenza" does not begin to show the true extent of the loss from this disease; a great many deaths primarily from influenza, but with a complicating pneumonia, were unavoidably recorded as having been due to pneumonia. It is therefore necessary to deal with estimates of the *excess* mortality from influenza and pneumonia combined in the years 1918 to 1920. Second, in order to measure approximately in terms of "excess mortality" the effect of the influenza *epidemic* at the several age divisions, we have assumed for purposes of this calculation, that the death rates for the year 1917 were as close to normal as the figures for any other year which could have been chosen. We have, accordingly, subtracted the death rates for "influenza-pneumonia" at the several age divisions for the year 1917 from those recorded in each of the years 1918 to 1920, and believe that the residual figures represent fairly accurately the effect of the epidemic conditions prevailing in these years. The table on page 33 gives the facts for the five-year period combined, and for each year, 1918 to 1920. The figures shown are the *excesses* in the death rates for influenza and pneumonia (combined) in the specified years over and above the figures prevailing for the year 1917.

TABLE 13

Death Rates per 100,000 from Influenza-pneumonia, 1918 to 1920, in Excess of Death Rates Prevailing in 1917 at Specified Age Periods. Intercompany Industrial Mortality Experience.

Age Period	Excess Over 1917 Rate				Rate in 1917	Per cent. Excess Rate in Specified Year of 1917 Death Rate			
	1916 to 1920	1920	1919	1918		1916 to 1920	1920	1919	1918
All ages—one and over..	114.3	29.3	84.6	441.4	129.0	89	23	66	342
1 to 4.....	148.2	35.2	79.6	554.5	243.9	61	14	33	227
5 to 9.....	45.6	14.4	40.2	166.9	30.6	149	47	131	545
10 to 14.....	38.9	12.1	34.4	142.5	17.4	224	70	198	819
15 to 19.....	93.6	28.9	79.5	359.6	29.8	314	97	267	1,207
20 to 24.....	189.0	66.0	174.0	688.2	33.7	561	196	516	2,042
25 to 34.....	281.6	116.9	265.9	1000.1	63.6	443	184	418	1,572
35 to 44.....	112.2	28.7	85.3	446.9	130.7	86	22	65	342
45 to 54.....	34.1	—36.1	1.1	220.7	219.2	16	—16	1	101
55 to 64.....	—3.2	—78.3	—70.0	144.6	402.9	—1	—19	—17	36
65 to 74.....	—10.1	—85.3	—178.5	133.2	835.3	—1	—10	—21	16
75 and over.....	114.3	212.5	—434.9	—60.0	1659.6	7	13	—26	—4

Note: Minus sign (–) denotes decrease.

Let us now consider separately the *excess* mortality occasioned by the influenza in each of the years 1918 to 1920.

The Influenza of 1918

The maximum death rate from influenza and pneumonia occasioned by the epidemic during 1918 was recorded at the age group 25 to 34 years. At this age division, 1 in every 100 of the policyholders exposed to risk died either from influenza or from pneumonia complicating influenza. When one considers that this death rate arose out of conditions prevailing within a few months in the latter part of 1918, this figure becomes one of the highest death rates ever recorded for epidemic disease in the history of public health. For the whole year 1918 at this age group, the "excess" death rate was nearly sixteen times that prevailing in the year 1917. At the age division 20 to 24 years, the mortality from influenza and pneumonia, arising out of the epidemic, gave a rate of 688 per 100,000, a figure somewhat less than that recorded at the age group 25 to 34 years. The death rate in 1918 was more than twenty times that prevailing at the same age group in the year 1917.

In general, the mortality curve, by age, for the year 1918, shows a crest in the ages of early childhood, 1 to 4 years, a decline in the succeeding years to a minimum in the age group 10 to 14 years, and then a sharp rise to the high crest at the age division 25 to 34 years. After this age division, the excess in mortality due to epidemic causes declined slowly to another minimum at the ages beyond 75

years. Considering only the age range from 20 to 45 years, there occurred in 1918 approximately 65,000 deaths from influenza and pneumonia which would not have occurred if the death rates of 1917 had prevailed.

Influenza in 1919

The effect of the declining influenza during the first quarter of 1919 may be seen from the figures at the several age divisions in that year. The maximum death rate still prevailed at the age division 25 to 34 years, with the next highest rate at the age division preceding,—20 to 24 years. There was a crest of excess mortality at the ages of early childhood. The rates declined to a minimum at the age division 10 to 14 years, rising again to a sharp maximum at the age group 25 to 34 years, and declining thereafter. In 1919, beyond 55 years of age, the death rates from influenza and pneumonia combined, were more favorable than those recorded in the year 1917.

Influenza in 1920

The recrudescence of influenza for a period of eight weeks in 1920 had approximately the same age characteristics, but occasioned a very much smaller loss of life, than did the influenzas prevailing during 1918 and 1919. In 1920, the maximum death rates were recorded at the age group 1 to 4 years, and at 25 to 34 years. Beyond age 45, in 1920, the death rates were lower than in 1917, with the exception of the age group 75 years and over.

Age Characteristics of Influenza in the Five-year Period, 1916 to 1920

The influence of epidemic conditions on the experience of the whole five-year period was such as to produce for this consolidated experience a curve having the general characteristics of the epidemic figures of 1918 and 1919. Taking the record of the whole five years, we found that the forces of the epidemic had produced on that experience a death rate from excess influenzal pneumonia which was nearly six times the experience of the year 1917 at the age division 20 to 24 years, and nearly four and one-half times the normal experience at the age group 25 to 34 years. For the five calendar years included in this experience, at the age division 20 to 45 years, we have computed that there occurred 89,452 deaths from influenza

and pneumonia over and above what was expected from the rates for the year 1917. At the age group 1 to 4 years, there was an excess of 15,559 in the number of deaths from influenza and pneumonia.

No satisfactory explanation has as yet been offered for the very marked concentration of influenza mortality at the adult ages. Furthermore, the influenza with pneumonic complications seemed, to some observers, to affect chiefly persons who were in rugged health. It is difficult to understand why such persons should have been particularly singled out.

Influenza in Relation to Economic Status

The facts compiled by one of the companies contributing to this experience show that influenza struck its heaviest blow at the wage-working groups of the population. The better circumstanced policyholders, as represented in the Ordinary Department of that Company suffered least. The group of lives insured on Intermediate plans, representing the workingmen able to afford insurance where premiums are payable quarterly, semi-annually or annually, showed a higher influenza mortality, and the Industrial group insured on weekly premium plans had the highest rates during the principal period of epidemic prevalence.

The heavier epidemic damage among the wage-working population probably arose out of the economic and social disabilities under which this group lives. They were less able to avoid infection, had less adequate facility to secure early diagnosis and proper care of the primary attack of influenza, and were, consequently, more disposed to contract the severe, fatal complicating pneumonia.

Influenza among Insured Wage-Earners and in General Population Compared

A comparison may be made of the facts for insured wage-earners and for the general population of the United States Registration Area in the table on the following page.

TABLE 14

Deaths and Death Rates per 100,000 from Influenza-Pneumonia Intercompany Industrial Mortality Experience and United States Registration Area (Ages 1 to 74 Years) Compared for Period, 1916 to 1920

YEAR	DEATH RATES PER 100,000			NUMBER OF DEATHS	
	Interco. Industrial	U.S. Reg. Area	Per cent. Interco. Ind'l of U.S. Reg. Area	Interco. Industrial	U.S. Reg. Area
1916 to 1920.	243.3	218.4	111.4	279,042	839,836
1920	158.3	161.2	98.2	40,829	133,743
1919	213.6	180.0	118.7	52,252	147,746
1918	570.4	510.0	111.8	130,501	400,103
1917	129.0	114.0	113.2	27,680	82,437
1916	138.3	110.2	125.5	27,780	75,807

The above comparison is likely to be misleading; apparently, the group of insured wage-earners was not affected adversely by the influenza to the same extent as was the population of the United States Registration Area. The 1918 crude excess mortality rate for influenza-pneumonia among insured wage-earners was 342 per cent., and among the general population 347 per cent., of the base rate for 1917. But when comparisons are made of the percentages which the excess mortality in 1918 and 1919 bore to the base rates of 1917, by ages, the group of insured wage-earners shows up worse at the significant age divisions where influenza hit the hardest. This is set forth in the following table:

TABLE 15

Percentage, Excess Mortality Rates per 100,000 from Influenza-pneumonia of Death Rates in 1917. Intercompany Industrial and U. S. Registration Area (Ages 1 to 74 Years) Compared.

Age Period	Percentage Excess Mortality in Specified Year of Rates for 1917							
	1916 to 1920		1920		1919		1918	
	Interco. Ind'l	U.S.Reg. Area	Interco. Ind'l	U.S.Reg. Area	Interco. Ind'l	U.S.Reg. Area	Interco. Ind'l	U.S.Reg. Area
All ages—one and over	89	92	23	41	66	58	342	347
1 to 4	61	56	14	20	33	31	227	225
5 to 9	149	145	47	55	131	130	545	533
10 to 14	224	220	70	94	198	209	819	777
15 to 19	314	302	97	172	267	250	1207	1030
20 to 24	561	337	196	190	516	247	2042	1179
25 to 34	443	384	184	212	418	282	1572	1363
35 to 44	86	122	22	65	65	80	342	455
45 to 54	16	27	—16	2	1	8	101	130
55 to 64	—1	—1	—19	—17	—17	—18	36	37
65 to 74	—1	—6	—10	—13	—21	—25	16	6
75 and over	7	*	13	*	—26	*	—4	*

*Not computed.
Note: Minus sign (–) denotes decrease.

At all ages under 35 years the toll of the influenza epidemic was heavier among insured wage-earners than in the general population. At the age division 20 to 24 years, the rates in 1918 among insured wage-earners were twenty times those for the year 1917 and for the general population only twelve times the 1917 rates. For the age period 25 to 34 years, where the highest death rates at any age group were reported in both experiences, the excess was sixteen times the 1917 base-rate for wage-earners and fourteen times for the general population. In 1919, also, the facts show that at significant age divisions the wage-working group suffered more heavily than the general population.

In 1920, the insured group showed a more favorable experience on excess epidemic mortality than did the population of the United States Registration Area. Taking the consolidated experience of the five-year period 1916 to 1920, the balance of mortality seems to have swung much more heavily against the insured group than against the general population.

In order that the absolute figures for excess mortality at the several age divisions for the United States Registration Area may be available for further study, and to facilitate comparison with the table for insured wage-earners on the same page, the two tables are shown on page 38.

Table 16

Death Rates per 100,000 from Influenza-pneumonia, 1918 to 1920, in Excess of Death Rates Prevailing in 1917 at Specified Age Periods.

United States Registration Area (Ages 1 to 74)

Age Period	Excess Over 1917 Rate				Rate in 1917	Per cent. Excess Rate in Specified Year of 1917 Death Rate			
	1916 to 1920	1920	1919	1918		1916 to 1920	1920	1919	1918
All ages—one to 74.....	104.4	47.1	66.0	396.0	114.0	92	11	58	347
1 to 4.....	132.0	46.2	72.6	525.8	233.8	56	20	31	225
5 to 9.....	48.2	18.2	43.0	177.1	33.2	145	55	130	533
10 to 14.....	43.4	18.5	41.2	153.1	19.7	220	94	209	777
15 to 19.....	93.9	53.4	77.7	320.4	31.1	302	172	250	1030
20 to 24.....	138.2	77.7	101.4	483.4	41.0	337	190	247	1179
25 to 34.....	223.7	123.6	164.4	794.7	58.3	384	212	282	1363
35 to 44.....	122.1	65.4	80.1	454.6	100.0	122	65	80	455
45 to 54.....	43.3	3.1	12.1	208.2	160.0	27	2	8	130
55 to 64.....	—2.5	—52.7	—54.1	113.1	308.5	—1	—17	—18	37
65 to 74.....	—36.7	—81.6	—158.9	38.3	623.9	—6	—13	—25	6

Note: Minus sign (–) denotes decrease.

Table 17

Deaths and Death Rates per 100,000 From Influenza-pneumonia. Intercompany Industrial Mortality Experience, Each Year, 1916 to 1920 by Age Periods.

Age Periods	Death Rate Per 100,000						Number of Deaths					
	1916 to 1920	1920	1919	1918	1917	1916	1916 to 1920	1920	1919	1918	1917	1916
All ages— one and over..	243.3	158.3	213.6	570.4	129.0	138.3	279,042	40,829	52,252	130,501	27,680	27,780
1 to 4.....	392.1	279.1	323.5	798.4	243.9	280.6	41,172	6,592	7,609	17,636	4,710	4,625
5 to 9.....	76.2	45.0	70.8	197.5	30.6	34.1	12,033	1,616	2,400	6,188	897	932
10 to 14.....	56.3	29.5	51.8	159.9	17.4	18.0	7,747	918	1,529	4,428	440	432
15 to 19.....	123.4	58.7	109.3	389.4	29.8	26.7	14,845	1,560	2,773	9,251	682	579
20 to 24.....	222.7	99.7	207.7	721.9	33.7	35.8	25,564	2,472	5,043	16,564	739	746
25 to 34.....	345.2	180.5	329.5	1063.7	63.6	59.2	64,843	7,691	13,215	39,774	2,226	1,937
35 to 44.....	242.9	159.4	216.0	577.6	130.7	124.2	31,890	4,786	5,996	15,058	3,199	2,851
45 to 54.....	253.3	183.1	220.3	439.9	219.2	210.8	24,606	4,052	4,543	8,426	3,977	3,608
55 to 64.....	399.7	324.6	332.9	547.5	402.9	406.4	25,512	4,612	4,432	6,811	4,915	4,742
65 to 74.....	825.2	750.0	656.8	968.5	835.3	936.2	21,150	4,196	3,428	4,782	4,185	4,559
75 and over.....	1773.9	1872.1	1224.7	1599.6	1659.6	2424.9	9,680	2,334	1,284	1,583	1,710	2,769

As a supplement to the other data in this section of the report, the table at the top of the following page is given.

TABLE 18

Deaths and Death Rates per 100,000 From Influenza-pneumonia—United States Registration Area (Ages 1 to 74 Years) Each Year 1916 to 1920 by Age Periods.

Age Periods	Death Rates Per 100,000						Number of Deaths					
	1916 to 1920	1920	1919	1918	1917	1916	1916 to 1920	1920	1919	1918	1917	1916
All ages— 1 to 74.....	218.4	161.1	180.0	510.0	114.0	110.2	839,836	133,743	147,746	400,103	82,437	75,807
1 to 4.....	365.8	280.0	306.4	759.6	233.8	234.4	121,436	20,717	21,514	50,967	14,452	13,786
5 to 9.....	81.4	51.4	76.2	210.3	33.2	31.1	31,270	4,607	6,114	16,116	2,342	2,091
10 to 14.....	63.1	38.2	60.9	172.8	19.7	18.3	23,106	3,189	4,690	12,712	1,335	1,180
15 to 19.....	125.0	84.5	108.8	351.5	31.1	29.4	46,270	6,265	8,765	27,054	2,203	1,983
20 to 24.....	179.2	118.7	142.4	524.4	41.0	38.2	69,258	8,834	12,091	42,549	3,065	2,719
25 to 34.....	282.0	181.9	222.7	853.0	58.3	51.2	193,193	25,812	32,930	120,520	7,590	6,341
35 to 44.....	222.1	165.4	180.1	554.6	100.0	89.2	122,497	19,543	21,240	62,515	10,383	8,816
45 to 54.....	203.3	163.1	172.1	368.2	160.0	148.8	80,489	14,472	14,387	29,426	11,781	10,423
55 to 64.....	306.0	255.8	254.4	421.6	308.5	299.8	73,467	14,317	12,752	20,194	13,615	12,589
65 to 74.....	587.2	542.3	465.0	662.2	623.9	664.4	78,850	15,987	13,263	18,050	15,671	15,879

V. PNEUMONIA

Lobar and bronchopneumonia, even in years when influenza is not widely epidemic, cause a considerable proportion of the deaths in a mortality experience. Thus, in 1917, the year prior to the influenza invasion, in the experience of these insured wage-earners, both forms of pneumonia combined caused 10.4 per cent. of all the deaths. At certain age-levels, the pneumonias are of even greater importance. Among wage-earners' children between 1 and 4 years of age in 1917, nearly 20 per cent. of the mortality was ascribed to pneumonia. At each of the age divisions beyond 35 years, in the same year, pneumonia, most of it non-influenzal, caused from 10 to 11 per cent. of all the deaths. A comparison of the recorded mortality from the pneumonias in each year of the present experience is shown below.

TABLE 19

Number of Deaths, Per Cent. of All Causes of Death, and Death Rates per 100,000. Pneumonia—all forms, 1916 to 1920. Intercompany Industrial Mortality Experience

Year	Number of Deaths			Death Rates per 100,000		
	All causes	Pneumonia all forms	Per cent. pneumonia of all causes	Pneumonia—all forms	Pneumonia lobar and undefined	Bronchopneumonia
1916 to 1920.....	1,335,857	151,195	11.3	131.8	95.2	36.6
1920	256,502	26,199	10.2	101.6	67.7	33.9
1919	252,348	26 536	10.5	108.5	74.1	34.4
1918	354,101	50,290	14.2	219.8	169.4	50.4
1917	239.715	24 989	10.4	116.5	85.3	31.2
1916	233,191	23,181	9.9	115.4	82.4	33.0

It is difficult to say anything of significance about the registered mortality experience from pneumonia during periods of excessive influenza prevalence, because so many deaths where the predisposing cause really is influenza are reported and consequently scheduled as "pneumonia." It is a fairly well established fact that many deaths from pneumonia of influenzal origin were recorded under "pneumonia" instead of under "influenza" during the three years 1918 to 1920. Yet, the recorded pneumonias accounted for about the same proportion of the total mortality in 1919 to 1920 as they did in the pre-influenza years. This means that the unadjusted pneumonia rate kept pace with the fall of mortality from all other causes of death, and allowing for a considerable number of influenzas unavoidably included, there must have been a much lower mortality from the usual pneumonias in these two later years than in the years preceding the epidemic. In 1919 and 1920, the recorded pneumonia death rates were below those for 1916 and 1917, but reference to the age-tables will show that much even of this lower mortality could be ascribed to the pneumonias typical of the influenza wave of 1918-1920. In fact, the favorable record of the years 1919 and 1920 arose entirely from the reduced death rates at the ages of childhood and in old age, where under "normal" conditions pneumonia rates are highest. Although it is impossible to give any numerical data of the fact, it is probably true that the pneumonias of the types prevalent in non-influenza years had mortality figures much below the "normal" in 1919 and 1920. This is emphasized by the facts available for one of the companies for the year 1921. In that year the pneumonia death rate was the lowest of a decade, and influenza was not prevalent sufficiently to color the results. There may have been for the three years 1919-1921, an abnormally low death rate for the pneumonias usually met with in medical experience.

Before passing on to a detailed discussion of pneumonia death rates, it may be of interest to include a table showing the importance of pneumonia—all forms, in the total mortality of the two years preceding the influenza pandemic.

TABLE 20

Percentage, Deaths from Pneumonia—All Forms, of Deaths from All Causes, 1916 and 1917. By Age Periods. Intercompany Industrial Mortality Experience.

AGE PERIODS	1917	1916
All ages—one and over	10.4	9.9
1 to 4	19.6	19.5
5 to 9	8.3	8.2
10 to 14	6.5	6.4
15 to 19	6.5	5.8
20 to 24	5.2	5.4
25 to 34	7.7	7.0
35 to 44	10.4	9.4
45 to 54	10.8	10.1
55 to 64	10.7	10.0
65 to 74	10.3	10.1
75 and over	10.1	9.3

Age Characteristics of Recorded Pneumonia Death Rates

In the following three tables we offer the full data available on the death rates from pneumonia—all forms, for pneumonia—lobar and undefined, and for bronchopneumonia. It is hoped that the figures will be of value to students who wish to make a more intensive analysis than is possible in a work of the present scope.

TABLE 21

Death Rates per 100,000 from Pneumonia—all forms. 1916 to 1920. By Age Periods

Intercompany Industrial Mortality Experience

AGE PERIODS	1916 to 1920	1920	1919	1918	1917	1916
All ages—one and over	131.8	101.6	108.5	219.8	116.5	115.4
1 to 4	241.0	199.5	182.5	344.2	229.3	259.1
5 to 9	35.2	29.6	31.3	59.1	27.1	28.8
10 to 14	22.9	17.7	19.5	47.1	14.9	14.4
15 to 19	49.1	34.0	43.7	118.3	26.9	21.7
20 to 24	95.1	54.8	94.8	259.7	30.3	30.3
25 to 34	137.7	93.7	137.6	337.4	58.5	52.0
35 to 44	125.2	92.2	96.9	208.3	122.5	111.3
45 to 54	167.3	121.6	128.8	213.6	202.2	184.2
55 to 64	291.6	232.6	216.4	337.4	357.9	330.9
65 to 74	622.7	560.7	472.9	661.8	720.2	714.6
75 and over	1322.0	1375.6	940.5	1169.1	1385.0	1689.3

TABLE 22

Death Rates per 100,000 from Pneumonia—lobar and undefined. 1916 to 1920. By Age Periods. Intercompany Industrial Mortality Experience

AGE PERIODS	1916 to 1920	1920	1919	1918	1917	1916
All ages—one and over.....	95.2	67.7	74.1	169.4	85.3	82.4
1 to 4.....	100.2	73.5	74.5	157.5	97.0	102.2
5 to 9.....	21.0	15.5	17.8	38.4	16.6	16.8
10 to 14.....	17.3	13.1	13.9	36.7	11.4	10.8
15 to 19.....	41.4	27.0	35.5	102.7	22.8	18.8
20 to 24.....	81.5	45.2	75.6	228.6	27.0	27.0
25 to 34.....	118.1	78.8	112.7	293.3	52.4	45.9
35 to 44.....	106.9	76.1	76.1	180.7	108.8	98.7
45 to 54.....	138.4	93.2	97.0	179.5	177.6	159.4
55 to 64.....	221.8	167.5	151.2	260.8	285.7	260.0
65 to 74.....	415.5	345.0	278.6	470.9	495.4	504.8
75 and over.....	762.5	725.9	498.8	702.3	818.2	1046.5

TABLE 23

Death Rates per 100,000 from Bronchopneumonia. 1916 to 1920. By Age Periods. Intercompany Industrial Mortality Experience

AGE PERIODS	1916 to 1920	1920	1919	1918	1917	1916
All ages—one and over.....	36.6	33.9	34.4	50.4	31.2	33.0
1 to 4.....	140.7	125.9	108.0	186.7	132.3	156.9
5 to 9.....	14.2	14.0	13.5	20.7	10.4	12.0
10 to 14.....	5.6	4.6	5.7	10 4	3 5	3.5
15 to 19.....	7.7	7.0	8.2	15.7	4.1	2.9
20 to 24.....	13.6	9.7	19 2	31.1	3 3	3.4
25 to 34.....	19.6	14.8	24.8	44.1	6.1	6.0
35 to 44.....	18.3	16.2	20.9	27.6	13.7	12.6
45 to 54.....	28.9	28.5	38.0	34.0	24.5	24.8
55 to 64.....	69.8	65.1	72.6	76.6	72.1	71.0
65 to 74.....	207.1	215.7	133 4	191.0	224.0	209 9
75 and over.....	560.2	649.7	269.9	466 8	570.7	642 8

Pneumonia Mortality Among Insured Wage-earners and in General Population

A comparative view of the recorded death rate from pneumonia—all forms, among insured wage-earners and in the general population of the United States Registration Area is afforded in the tables on page 43.

TABLE 24

Deaths and Death Rates per 100,000 from Pneumonia (all forms) Intercompany Industrial Mortality Experience and United States Registration Area (Ages One to 74 Years), Compared for Period 1916 to 1920

Year	Death Rates per 100,000			Number of Deaths	
	Interco. Ind'l.	U. S. Reg. Area	Per cent. Interco. of U. S. Reg. Area	Interco. Ind'l.	U. S. Reg. Area
1916 to 1920.....	131.8	125.2	105.3	151,195	481,700
1920	101.6	99.6	102.0	26,199	82,607
1919	108.5	91.3	118.8	26,536	74,969
1918	219.8	234.0	93.9	50,290	183,604
1917	116.5	104.1	111.9	24.989	75,254
1916	115.4	94.9	121.6	23,181	65,266
Per cent. decline 1916-1920	12.0	5.0*	....	....	....

* Increase.

The comparative data by broad age divisions are shown in the following table:

TABLE 25

Death Rates per 100,000 from Pneumonia (all forms) Intercompany Industrial Mortality Experience and United States Registration Area (Ages 1 to 74 Years) Compared by Age Periods for Quinquennium 1916 to 1920

Age Periods	Interco. Industrial	U. S. Reg. Area	Per cent. Interco. Ind'l. of U. S. Reg. Area
All ages—one and over*.....	131.8	125.2	105.3
1 to 4.....	241.0	236.1	102 1
5 to 9.....	35.2	40.2	87.6
10 to 14.....	22.9	28.5	80.4
15 to 19.....	49.1	57.0	86.1
20 to 24.....	95.1	84.4	112.7
25 to 34.....	137.7	130.4	105 6
35 to 44.....	125.2	120.5	103.9
45 to 54.....	167.3	136.3	122.7
55 to 64.....	291.6	227.3	128.3
65 to 74.....	622.7	442.7	140.7

* Ages 1 to 74 years for U. S. Registration Area.

VI. ORGANIC DISEASES OF THE HEART*

Organic heart disease was third in numerical importance among the causes of death of the Industrial policyholders of the five cooperating companies, having been outranked by tuberculosis and pneumonia only. But for the presence of epidemic influenza, with its resulting increase in pneumonia mortality, heart disease would have ranked as the second cause of death. Organic cardiac diseases caused 146,193 deaths, corresponding to a death rate of 127.5 per 100,000 Industrial policyholders. These conditions were thus responsible for 10.9 per cent. of the total mortality among the Industrial wage-earners. This may be compared with the 13.3 per cent. caused by all forms of tuberculosis, with 11.3 per cent. by the various types of pneumonia and with 20.9 per cent. for both influenza and pneumonia combined.

Heart Disease an Important Cause of Death at All Age Periods

Organic heart disease is an important cause of death at every age of life. Even at the ages one to four it caused 747 deaths of wage-earners' children. This is nearly one-third as many as were charged to scarlet fever in this age group; it is about one-half as many as were caused by pulmonary tuberculosis; it is over one-third the number due to acute poliomyelitis and is considerably more than the number classified under cerebrospinal fever.

In the age group five to nine years, heart disease caused more deaths in this insurance experience than did any of the so-called "children's diseases" with the single exception of diphtheria, and in this age group it had a much higher mortality than did pulmonary tuberculosis. We do not, as a rule, think of nor refer to any of the several forms of organic heart disease as a "children's disease," because its relatively higher death rates with advancing age tend to obscure its importance as a cause of death in childhood; but if we measure its importance by comparing its mortality among children with that of those other disorders which are generally considered to be the chief causes of child mortality, we shall find that cardiac disease ranks very high indeed. This is brought out very clearly by considering as a single age group the wage-earners' children between the ages of one and fifteen years. In this group (which

* Includes: Chronic valvular conditions, fatty degeneration, chronic myocarditis, dilatation, hypertrophy, "heart disease" unqualified, also chronic heart diseases of rheumatic origin. Does not include acute endocarditis, acute myocarditis, or "endocarditis" or "myocarditis," unqualified, for decedents under 60 years of age. Pericarditis, functional and indeterminate cardiac symptoms, were classed under other titles.

covers all the years of childhood save the first), heart disease caused more deaths than did scarlet fever or whooping cough; it was responsible for twice as many deaths as was acute poliomyelitis, and for six times as many as cerebrospinal fever; it caused three-quarters as much mortality as did measles and one-quarter as many deaths as diphtheria.

In adolescence, also, organic cardiac diseases take a heavy toll of life; in fact, the 3,454 deaths recorded at ages 15 to 19 in this report constitute 5.8 per cent. of the total mortality in this age group. In the first period of early adult life, 20 to 24 years, cardiac disease was responsible in this insurance experience for a death rate of 29.1 per 100,000. From this age division, on through the higher ages the death rate increased sharply with advancing age. At ages 35 to 44 years, tuberculosis, pneumonia and influenza were the only diseases responsible for higher mortality than was cardiac disease; and in the "normal" years of the period covered by this report, the heart disease death rate far exceeded that for influenza. In this age group, 7.9 per cent. of all the deaths was due to cardiac conditions. In the age period 45 to 54 years, tuberculosis was the only cause of death whose mortality exceeded that of organic heart disease. Here the latter accounted for 12.1 per cent. of all the deaths. At 55 to 64 and 65 to 74 years and at 75 years and over, with death rates of 540.8, 1494.0 and 3678.2 per 100,000, respectively, chronic cardiac disease was far and away the leading cause of death. In the age group 55 to 64 years it caused 17.3 per cent. of the total mortality; at 65 to 74 and at 75 years and over these percentages were 22.2 and 23.1, respectively.

The table on the following page shows the number of deaths and the death rates per 100,000 Industrial policyholders of the five cooperating companies for all ages combined and for each significant age group during the five-year period 1916 to 1920.

TABLE 26

Deaths and Death Rates per 100,000 from Organic Diseases of the Heart.

Intercompany Industrial Mortality Experience, 1916 to 1920.

By Age Periods.

AGE PERIODS	Number of Deaths	Death Rates per 100,000
All ages—one and over	146,193	127.5
1 to 4	747	7.1
5 to 9	2,187	13.9
10 to 14	3,248	23.6
15 to 19	3,454	28.7
20 to 24	3,343	29.1
25 to 34	8,321	44.3
35 to 44	11,992	91.3
45 to 54	20,019	206.0
55 to 64	34.516	540.8
65 to 74	38,294	1494.0
75 and over	20.072	3678.2

Heart Disease Among Insured Wage-Earners and in the General Population

Heart disease is of more importance as a cause of death among wage-earners than it is in the population at large. This is shown clearly by the tables on pages 47 and 49, in which death rates are given for the insured, and for the general population between the ages of one and seventy-four years. In each year of the period 1916 to 1920, the death rate for the insured group exceeds that of the population in spite of the fact that the insurance figures relate to an exposure made up almost entirely of white persons, while the figures for the general population are based, in part, upon a considerable colored population whose heart disease death rate is much higher than that of the whites. Comparing the two experiences, age period by age period, we find in the age range from 25 to 54 years an excess of about 26 per cent. in the heart disease death rate of insured wage-earners. In adolescence, between 15 and 19 years, the mortality for the insured group is 50 per cent. in excess of that in the general population.

The table and chart on the following pages show the death rates for organic diseases of the heart for the Industrial policyholders of the five cooperating companies and for the general population of the United States Registration Area aged one to 74 years, for each year of the period 1916 to 1920.

TABLE 27

Deaths and Death Rates per 100,000 from Organic Diseases of Heart.

Intercompany Industrial Mortality Experience and United States Registration Area, (Ages one to 74 years), Compared for Period 1916 to 1920.

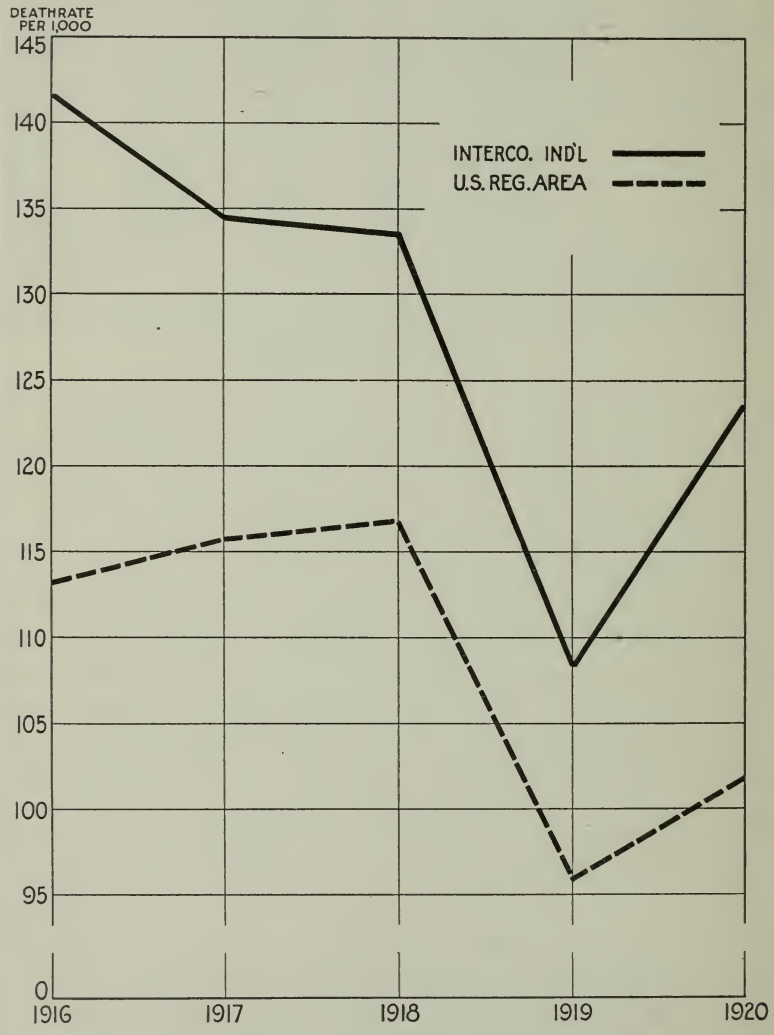
YEAR	DEATH RATES PER 100,000			NUMBER OF DEATHS	
	Interco. Ind'l.	U. S. Reg. Area	Per cent. Interco. of U. S. Reg. Area	Interco. Ind'l.	U. S. Reg. Area
1916 to 1920.....	127.5	108.3	117.7	146,193	416,446
1920	123.6	101.8	121.4	31,874	84,489
1919	108.3	95.9	112.9	26,491	78,759
1918	133.5	116.8	114.3	30,547	91,659
1917	134.5	115.7	116.2	28,863	83,660
1916	141.5	113.2	125.0	28,418	77,879
Per cent. decline 1916-1920	12.7	10.1	....	....	....

CHART V.

Organic Diseases of Heart.

Deathrate per 100,000. 1916 to 1920.

Intercompany Ind'l Mortality Experience & U.S. Reg. Area (ages 1 to 74 years) Compared



The following table presents the death rates for organic diseases of the heart for the Industrial policyholders of the five cooperating companies and for the general population of the United States Registration Area (ages one to 74 years), compared for each significant age group:

TABLE 28

Death Rates per 100,000 from Organic Diseases of the Heart. Intercompany Industrial Mortality Experience and United States Registration Area (Ages 1 to 74 years) Compared by Age Periods for Quinquennium 1916 to 1920.

AGE PERIODS	Interco. Ind'l.	U. S. Reg. Area	Per cent. Interco. Ind'l. of U. S. Reg. Area
All ages—one and over*.....	127.5	108.3	117.7
1 to 4.....	7.1	6.7	106.0
5 to 9.....	13.9	11.8	117.8
10 to 14.....	23.6	18.2	129.7
15 to 19.....	28.7	19.3	148.7
20 to 24.....	29.1	21.7	134.1
25 to 34.....	44.3	35.1	126.2
35 to 44.....	91.3	72.3	126.3
45 to 54.....	206.0	162.5	126.8
55 to 64.....	540.8	444.0	121.8
65 to 74.....	1494.0	1136.8	131.4

* Ages 1 to 74 years for U. S. Reg. Area.

Preventability of Heart Disease Mortality

Organic heart disease became, in the earlier years of the decade 1911 to 1920, the leading cause of death in the general population, displacing tuberculosis and pneumonia. That it is rapidly displacing tuberculosis as the leading cause of death among the wage-earning group is brought out very clearly by the mortality experience of the Industrial Departments of the companies cooperating in this study. It is now recognized by the medical profession and by public health workers in general that a large proportion of the deaths from heart disease is preventable and that other thousands of these deaths occur annually which are at least postponable.

Among the suggested measures for lowering mortality from cardiac disease is better care of the teeth. Quite recently the Dental Society of one of the states, in an inquiry in which it was assisted by one of the companies participating in this study, ascertained that in 117 cases of death from mitral regurgitation, dental or oral infection

was a recognized causative factor in 11 or 9.4 per cent. These 11 deaths were thus in the "preventable" class and, presumably, would not have occurred had there been proper care of the teeth. Other focal infections, notably tonsilitis, are now recognized causes of cardiac disease. The increasing practice of early tonsillectomy should operate to reduce the heart disease death rate. A number of observations of hospital experience have shown a lessened incidence of acute rheumatic fever, a possible consequence of surgical relief for infected tonsils. Since acute rheumatic fever is so often a cause of damaged mitral valves, it is probable that there are fewer damaged hearts today as a result of the attention given diseased tonsils during the past two decades.

The value of periodic medical examinations in bringing about early diagnosis and relief of heart impairments is becoming recognized to a greater extent each year. As a result of such early diagnosis persons with heart trouble have the benefit of the knowledge of its existence, and are thus enabled to regulate, in some degree at least, such important items as diet, exercise, and various habits of life which are important factors in prolonging the lives (or hastening the deaths) of cardiacs. Periodic medical examinations, it is true, on account of their cost, are not available at this time to the average Industrial policyholder. It would be a distinct forward step on the part of the public health movement if the cost of such examinations could be so reduced that they would be within the reach of many thousands of persons who cannot under present conditions benefit by them. But there are open to the wage-earning group in many cities heart disease clinics in which diagnoses are made without cost and where advice is given as to the best means of prolonging life.

It has been estimated that there are over two million men, women and children in the United States suffering from serious heart impairments; and it is known that persons with heart disease have a death rate of at least double the normal. This death rate could be materially reduced by well-directed preventive work through the public health movement. More school medical inspection, more instruction in industrial hygiene, a wider dissemination of facts concerning the causal relationship between focal infections and cardiac disease, more advice on personal and occupational hygiene to those suffering from heart impairments—better directed efforts along these lines would reduce the heart disease death rate materially.

We find a greater downward tendency of the death rate among insured wage-earners than in the general population. This is evident

from the chart on page 48. The fall was 6.2 points per 100,000 per year for the insured group and 4.3 for the general population. This advantage in favor of insured wage-earners accrues probably from the vastly improved status of the wage-working population during and after the War. It will be interesting to see whether this tendency will be become even more marked as wages and living conditions of industrial workers still further improve.

Heart Disease and the Influenza Pandemic of 1918

The influenza pandemic undoubtedly hastened the deaths of persons afflicted with chronic heart disorders at those age ranges where the invasion hit hardest. In the following table we show the death rates per 100,000 in each year 1916 to 1920, at the age divisions above 20 years:

TABLE 29

Death Rates per 100,000 from Organic Diseases of the Heart. Intercompany Industrial Mortality Experience Each Year, 1916 to 1920. By Age Periods

AGE PERIODS	1920	1919	1918	1917	1916
20 to 24.....	26.1	24.8	37.9	28.7	28.6
25 to 34.....	35.3	38.3	58.7	45.3	45.9
35 to 44.....	77.2	79.3	104.9	99.2	100.7
45 to 54.....	182.8	177.8	221.7	231.4	225.8
55 to 64.....	509.0	482.5	577.6	589.7	555.7
65 to 74.....	1447.8	1371.3	1600.9	1537.6	1525.6

It is possible that quite a number of deaths of cardiacs were recorded under the totals for influenza or pneumonia. But in most cases where the physician certified that both chronic disease of the heart and either acute influenza or pneumonia were present at the time of death, the death was classed under organic diseases of the heart in these statistics. The chief fact in the foregoing table is that no pronounced disturbance in the recorded death rates for heart disease was observed in 1918 at those ages beyond 45 years where there is the largest proportion of persons affected by cardiac disorders. And this was expected because the influenza exacted its heaviest toll below forty-five years of age. It is indeed possible, although physical examination surveys have not produced the facts as yet, that many persons were left by the influenza with weakened arterial, cardiac and renal systems, and that this will show in the mortality

records of the future. That influenza caused a veritable catharsis among cardiacs seems improbable because of the age distribution of that epidemic disease. The lower death rates from heart disease in 1919 and subsequent years can hardly be explained on these grounds, because the significant decreases occurred at the ages which were passed over by the influenza.

VII. BRIGHT'S DISEASE

Bright's disease, in its chronic form (chronic nephritis), ranked fifth in numerical importance among the causes of death of the Industrial policyholders of the five cooperating companies, being exceeded only by tuberculosis, pneumonia, organic heart disease and influenza. In three of the five years, 1916, 1917 and 1920, the number of deaths from Bright's disease far exceeded that from influenza, and under non-epidemic conditions the former was the fourth cause of death numerically. Bright's disease caused 7.2 per cent. of the total mortality at all ages. Of minor importance in the early age groups, the mortality from this disease begins to assume considerable importance in this Industrial insurance experience in the age period 25 to 34 years, in which group 5,113 deaths were registered with a death rate of 27.2 per 100,000. In each succeeding age period the mortality rose sharply, approximating in most instances, an increase of 150 per cent. from one age period to the next higher one. At ages 25 to 34 Bright's disease was responsible for 2.7 per cent. of all the deaths; at 35 to 44 years, this per centum was 6.4; at 45 to 54 it was 10.2; at 55 to 64, 12.6; at 65 to 74, 13.8; and at 75 years and over, 13.0. In the age group, 55 to 64, Bright's disease was the third cause in numerical importance among the Industrial policyholders, being outranked by only heart disease and cancer. At ages 65 to 74, organic heart disease is the only condition whose death rate exceeded that for Bright's; while at 75 years and over, Bright's disease again ranked third with organic heart disease and cerebral hemorrhage the only causes of death with higher mortality.

The following table shows the number of deaths from Bright's disease and the death rates per 100,000 Industrial policyholders of the five cooperating companies, for all ages combined, and for each significant age group during the five-year period, 1916 to 1920:

TABLE 30

Deaths and Death Rates per 100,000 from Bright's Disease. Intercompany Industrial Mortality Experience, 1916 to 1920 By Age Periods

AGE PERIODS	Number of Deaths	Death Rates per 100,000
All ages—one and over	96,274	84.0
1 to 4	447	4.3
5 to 9	559	3.5
10 to 14	659	4.8
15 to 19	986	8.2
20 to 24	1,532	13.3
25 to 34	5,113	27.2
35 to 44	9,774	74.4
45 to 54	16,928	174.2
55 to 64	25,037	392.3
65 to 74	23,957	934.7
75 and over	11,282	2067.4

The above table shows that 35,239 deaths, or 36.6 per cent. of the total Bright's disease deaths among the wage-earners occurred among policyholders over 65 years of age; 60,276 deaths, or 62.6 per cent. were those of persons over 55 years of age. If we take 60 years as the point marking the beginning of the "senile" period of life, our figures indicate that approximately one-half of all the Bright's disease mortality in the wage-earning group of the population occurs among the aged. In addition to this high mortality among elderly persons, it will be noted that 2,651 deaths of policyholders aged one to nineteen years were recorded as due to Bright's disease. There is considerable doubt attached to the reliability of the classification under this heading of a large proportion of the deaths of young persons so recorded. Probably many of these deaths were actually due to *acute* rather than to chronic nephritis. Deaths from the acute form are not properly chargeable to the "Bright's disease" total, as the International List of Causes of Death provides a separate heading for deaths from acute nephritis, the intent being to assign to "Bright's disease" only those due to the chronic form of the disease. Owing to the fact that physicians sometimes fail to specify on death certificates the acute nature of fatal nephritis, an appreciable number of deaths from the acute form of the disease are tabulated under the "Bright's disease" total. Fortunately, however, the "Bright's disease" mortality rate in these early age groups is relatively small, and the inclusion of these few deaths does not

affect the grand total for Bright's disease appreciably, even though it does present an exaggerated picture of the mortality from *chronic* Bright's disease among children and adolescents.

One of the most striking items in connection with the study of the mortality from Bright's disease among the wage-earners is the high death rate of this group in comparison with that of the general population. This is shown very clearly by the table on page 55. Accountable in part for the higher death rate of the wage-earners may be their concentration in the cities where the Bright's disease death rate, as a general proposition, is higher than in the rural districts. There are several factors, however, which tend to offset this. The most important is a higher ratio of persons in the advanced age groups (where the bulk of the deaths from Bright's disease occurs) in the general population than among the Industrial policyholders. Another factor is the inclusion of a considerable number of negroes with their high Bright's disease death rate, in the Registration Area population. As this insurance study relates to white policyholders, the inclusion of these negroes would tend to bring about the higher death rate in the general population. A third item is the higher ratio of males to females in the general population, as compared with the Industrial policyholders; and as males suffer a much higher Bright's disease death rate than do females, this factor, also, would operate to bring about a higher mortality in the general population. These three factors should counterbalance largely, if not altogether, the unfavorable influence of the almost wholly urban environment of the Industrial policyholders; and if there were no considerations other than those noted above we would expect to see no appreciable difference between the Bright's disease death rate of the wage-earners and that of the general population. But the fact remains that the death rate of the former was the higher in each year of the period 1916 to 1920; and that, without exception, the excess was large, running from a minimum of 14.4 per cent. in the year 1919 to a maximum of 29.3 per cent. in 1916.

The less favorable showing of the wage-earners with respect to the Bright's disease death rate is probably dependent upon several factors: the more arduous character of their daily work; their more general disregard for personal hygiene; their greater susceptibility to cardiovascular disease (which often superinduces or complicates Bright's disease); their inability to leave their homes and go to places where more equable climate would prolong life; their more general use of patent medicines to the exclusion of medical advice

and attendance; and, often, the less competent character of medical attendance available to them as compared with that enjoyed by those of better economic status. All of these are doubtless more or less important factors responsible for the relatively high death rate from chronic nephritis among wage-earners.

The following table presents for the Industrial policyholders of the five cooperating companies and for the population of the Registration Area, aged one to 74 years, the number of deaths from and the death rates for Bright's disease for each year of the quinquennium 1916 to 1920:

TABLE 31

Deaths and Death Rates per 100,000 from Bright's Disease. Intercompany Industrial Mortality Experience and United States Registration Area, (Ages 1 to 74 years), Compared for Period 1916 to 1920

Year	Death Rates per 100,000			Number of Deaths	
	Interco. Ind'l.	U. S. Reg. Area	Per cent. Interco. of U. S. Reg. Area	Interco. Ind'l.	U. S. Reg. Area
1916 to 1920.....	84.0	70.0	120.0	96,274	269,305
1920	74.5	61.8	120.6	19,222	51,251
1919	71.5	62.5	114.4	17,487	51,304
1918	81.9	71.1	115.2	18,783	55,808
1917	95.8	79.4	120.7	20,549	57,363
1916	100.7	77.9	129.3	20,233	53,579
Per cent. decrease 1916-1920	26.0	20.7	....	....	....

The trend of the Bright's disease death rate during the quinquennium was distinctly downward. This is true both for the Industrial policyholders and for the general population, and is brought out strikingly by the above table. The decline in the death rate for this disease was much more pronounced among the insured, however.

The following table presents the rates for Bright's disease for the Industrial policyholders of the five cooperating companies and for the general population of the United States Registration Area (ages one to seventy-four years) compared for each significant age group:

TABLE 32

Death rates per 100,000 from Bright's Disease. Intercompany Industrial Mortality Experience and United States Registration Area (Ages 1 to 74 years), Compared. By Age Periods for Quinquennium 1916 to 1920

AGE PERIODS	Interco. Ind'l.	U. S. Reg. Area	Per cent. Interco. Ind'l. of U. S. Reg. Area
All ages—one and over*.....	84.0	70.0	120.0
1 to 4.....	4.3	4.9	87.8
5 to 9.....	3.5	3.5	100.0
10 to 14.....	4.8	4.4	109.1
15 to 19.....	8.2	6.6	124.2
20 to 24.....	13.3	10.4	127.9
25 to 34.....	27.2	20.3	134.0
35 to 44.....	74.4	51.3	145.0
45 to 54.....	174.2	126.7	137.5
55 to 64.....	392.3	305.6	128.4
65 to 74.....	934.7	688.8	135.7

* Ages 1 to 74 years for U. S. Registration Area.

Analysis of the death rate of the two experiences by age groups shows clearly that with the exception of early childhood (when few deaths occur) wage-earners and their families at every period of life suffer higher mortality from Bright's disease than obtains for similar age periods in the general population. The excesses are particularly pronounced at the main working periods of life and in old age.

VIII. ACCIDENTS (including unspecified violence)*

Accidents, including unspecified violence,* caused 83,891 deaths of Industrial policyholders of the five cooperating companies during the five year period to which this report relates. This corresponds to a death rate of 73.2 per 100,000 exposed. Thus, accidents ranked sixth in numerical importance among the causes of death, their mortality being exceeded by only tuberculosis, pneumonia, heart disease, influenza and Bright's disease in the order named. In this

* In the general classification of accidents are tabulated, not only deaths of assured accidental character, but also violent deaths in cases where it is impossible to determine whether death was due to accident, suicide, or homicide. Thus, classification procedure, with reference to deaths tabulated under "accidents," is diametrically opposed to that governing those placed under suicide and homicide. With these there must be evidence of the suicidal or homicidal character of the death before it is counted in either of these groups. Therefore, in all mortality statistics of "Accidents" there is always included a more or less important percentum of deaths which *might* have been due to suicide or homicide but which were, perforce, placed under the accident total on account of lack of definitive data. Deaths from battle casualties are not included in these data for accidents. War deaths will be discussed elsewhere.

insurance experience they caused 1,281 more deaths than cancer, the seventh cause in numerical importance, and 11,919 more than cerebral hemorrhage, which ranked eighth. Accidents were responsible for 6.3 per cent. of all the deaths in this representative group of the wage-earning population of the United States and Canada. How large a problem the toll of accidental death has become may perhaps be illustrated in no better way than by making a comparison of the mortality from this cause with that due to diseases of primary public health interest. For example, there are the four principal communicable diseases of childhood: measles, scarlet fever, whooping cough and diphtheria. In this insurance experience, accidents caused nine times as many deaths as measles, fifteen times as many as scarlet fever, fourteen times as many as whooping cough and three times as many as diphtheria—in fact, they numbered almost twice as many as the total of these four diseases combined. Even when comparison is restricted to the ages of childhood, one to fourteen years, we find that the total of 25,065 accidental deaths slightly exceeds the mortality from diphtheria for the same ages, and is from three to five times that of measles, scarlet fever, or whooping cough. To every one death from typhoid fever there were for all ages combined nine from accidental causes. The accident fatality total is about 47 per cent. of that of tuberculosis, about 55 per cent. of that of pneumonia and about 66 per cent. of the influenza total. Even in the early age groups, where most of the deaths from diarrheal diseases occur, there were far more deaths from accident than from the former, while at all ages the accident fatality total is approximately three and one-half times that for diarrhea and enteritis.

Accidents are an important cause of death in every age group, but especially so in old age and early childhood. Among policyholders aged one to four years there were 9,525 deaths in this experience with a rate of 90.7 per 100,000; here this constituted seven and five-tenths per cent. of the mortality from all causes. At ages five to nine, diphtheria was the only cause of death which had a higher mortality than accidents and the margin was very small at that, the rate for the former being 59.3 per 100,000 as compared with 58.3 for the latter. In this age group, fatal accidents were responsible for 16.4 per cent., or substantially one-sixth of the total mortality. At ten to fourteen years, accidents with a death rate of 46.1 per 100,000 were far and away the leading cause of death, the 6,341 deaths comprising 17.8 per cent. of the total mortality. In every age range a considerable fraction of the mortality was due to accidental

violence. At 15 to 19 years the per cent. of all deaths was 11.7; at 20 to 24 years 7.0; at 25 to 34 years 5.5; at 35 to 45 years, 5.9; at 45 to 54 years, 5.3; at 55 to 64 years, 4.1; at 65 to 74 years, 3.3, and in the highest age group, 3.8.

The following table shows the number of deaths from accidental and unspecified violence and the death rates per 100,000 Industrial policyholders of the five cooperating companies for all ages combined and for each age group during the five year period 1916 to 1920:

TABLE 33

Deaths and Death Rates per 100,000 from All Accidents. Intercompany Industrial Mortality Experience, 1916 to 1920 By Age Periods

AGE PERIODS	Number of Deaths	Death Rates per 100,000
All ages—one and over	83,891	73.2
1 to 4	9,525	90.7
5 to 9	9,199	58.3
10 to 14	6,341	46.1
15 to 19	6,980	58.0
20 to 24	6,464	56.3
25 to 34	10,413	55.4
35 to 44	8,921	68.0
45 to 54	8,775	90.3
55 to 64	8,205	128.6
65 to 74	5,769	225.1
75 and over	3,299	604.5

The accident death rate was very slightly higher for the Industrial group than for the general population. This is true of the gross rate for all ages and of all of the age groups with the exception of 25 to 34 and 35 to 44 years. The differences are small, for the most part, although that for ages 65 to 74 years amounted to 32 per cent.

The following table presents the rates for accidents for the Industrial policyholders of the five cooperating companies and for the general population of the United States Registration Area (ages one to 74 years) compared for each significant age group:

TABLE 34

Death rates per 100,000 from All Accidents. Intercompany Industrial Mortality Experience and United States Registration Area (Ages 1 to 74 years) Compared. By Age Periods for Quinquennium 1916 to 1920

AGE PERIODS	Interco. Ind'l.	U. S. Reg. Area	Per cent. Interco. Ind'l. of U. S. Reg. Area
All ages—one and over*.....	73.2	71.3	102.7
1 to 4.....	90.7	88.3	102.7
5 to 9.....	58.3	53.2	109.6
10 to 14.....	46.1	41.7	110.6
15 to 19.....	58.0	51.7	112.2
20 to 24.....	56.3	55.6	101.3
25 to 34.....	55.4	61.1	90.7
35 to 44.....	68.0	73.9	92.0
45 to 54.....	90.3	89.0	101.5
55 to 64.....	128.6	116.0	110.9
65 to 74.....	225.1	170.6	131.9

* Ages 1 to 74 years for U. S. Reg. Area.

The accident rate declined materially and continuously in both the insurance and general population experiences during four of the five years covered by this report. The highest death rates (79.4 for the policyholders and 79.5 for the Registration Area) were recorded for the year 1917 and represent small increases over the 1916 figures. When the minimum rates of 1920 are compared with the maximum figures for 1917 we note a decline of 17.6 per cent. for the policyholders and one of 20 per cent. for the general population.

The following table presents for the Industrial policyholders of the five cooperating companies and for the general population of the United States Registration Area, the number of deaths and the death rates per 100,000 for accidents for each year of the quinquennium 1916 to 1920:

TABLE 35

Deaths and Death Rates per 100,000 from All Accidents Intercompany Industrial Mortality Experience and United States Registration Area, (Ages 1 to 74 years) Compared For Period 1916 to 1920

YEAR	DEATH RATES PER 100,000			NUMBER OF DEATHS	
	Interco. Ind'l.	U. S. Reg. Area	Per cent. Interco. of U. S. Reg. Area	Interco. Ind'l.	U. S. Reg. Area
1916-1920	73.2	71.3	102.7	83,891	274,330
1920	65.4	63.7	102.7	16,856	52,871
1919	68.2	65.3	104.4	16,695	53,576
1918	78.1	73.6	106.1	17,873	57,710
1917	79.4	79.5	99.9	17,040	57,431
1916	76.8	76.7	100.1	15,427	52,742
Per cent. decrease 1916-1920	14.8	16.9	....	....	....

Types of Fatal Accident*

The foregoing comments and tables relate to all forms of accident as a group. We shall now proceed to discuss separately the facts relating to the mortality due to the five most important types of accidental injury; for it is to the statistics of mortality caused by each of the several means involved in accident fatalities that the greatest interest attaches—more especially that of agencies concerned with accident prevention.

A comparison of the death rates for the five chief means of accidental injury are shown in the following table:

* There were 31,540 deaths of Industrial policyholders caused by forms of accidental violence other than the five principal forms discussed in this report. There follows a list of the modes of violence involved in these 31,540 deaths:

Poisoning by food
Other acute poisonings
Conflagrations
Absorption of deleterious gases—conflagration excepted
Traumatism by fire-arms
Traumatism by cutting or piercing instruments
Traumatism in mines and quarries
Traumatism by machines
Street car accidents and injuries
Injuries by other vehicles
Landslide, other crushing
Injuries by animals
Starvation
Excessive cold
Effects of heat
Lightning
Electricity—lightning excepted
Fractures—cause not specified
Other external violence

TABLE 36

Death Rates per 100,000 from Principal Means or Agencies of Accidental Injury

Intercompany Industrial Mortality Experience 1916 to 1920

MEANS OF INJURY	Death rate per 100,000	Per cent. of Total
All accidents and unspecified violence...	73.2	100.0
Burns	8.5	11.6
Accidental drowning	8.6	11.7
Traumatism by fall	10.8	14.8
Railroad accidents *	7.7	10.5
Automobile accidents *	10.5	14.3
All other accidents	27.1	37.0

* Computed with exposure for Life Insurance Company of Virginia omitted. Deaths from railroad and automobile accidents not separately reported for experience of this Company.

(a) Traumatism by Fall †

As noted above, accidental falls caused more deaths in this experience than any other form of accidental violence. The number was 12,342 with a death rate of 10.8 per 100,000.

The death rate for this cause was high in early childhood as compared with the later periods of childhood, with adolescence and with early adult life. Beginning with the age group 35 to 44 years there was a sharp rise in the mortality, and this became more pronounced with increasing age. It is the old people who suffer most from accidental falls, but this type of accident is also an important cause of death in middle life.

The death rate in this insurance experience at ages 35 to 44 (10.1 per 100,000) exceeded that of the age period one to four years (8.7). If our data enabled us to analyze these death rates by sex, we would undoubtedly find that the preponderance of the accidental fall fatality rate in middle age over that for early childhood applied to males alone. Prior studies of the subject show that for females the mortality of early childhood is more than double that of the age group 35 to 44, while for males, on the other hand, the rate at ages 35 to 44 is about triple that of boys aged one to four years.

† It should be understood that not *all* the deaths due to accidental falls are classified under this heading. Falls from street cars, automobiles and other vehicles, steam railroad trains, as well as falls in mines and quarries and in burning buildings are classified under other headings.

The following table shows the number of deaths from traumatism by fall and the death rates per 100,000 Industrial policyholders of the five cooperating companies for all ages combined and for each age group during the five year period 1916 to 1920:

TABLE 37

Deaths and Death Rates per 100,000 from Traumatism by Fall. Intercompany Industrial Mortality Experience, 1916 to 1920 By Age Periods

AGE PERIODS	Number of Deaths	Death Rates per 100,000
All ages—one and over	12,342	10.8
1 to 4	916	8.7
5 to 9	553	3.5
10 to 14	402	2.9
15 to 19	379	3.2
20 to 24	441	3.8
25 to 34	1,084	5.8
35 to 44	1,331	10.1
45 to 54	1,605	16.5
55 to 64	1,916	30.0
65 to 74	2,052	80.1
75 and over	1,663	304.7

Traumatism by fall was a more important cause of death among the Industrial policyholders than in the general population by a margin of 26 per cent. The rate for the policyholders was 10.8 per 100,000 as compared with 8.6 in the population of the United States Registration Area aged one to seventy-four years. At every age group, with the exception of 5 to 9, the insured suffered the higher mortality. The differences are small until the age period 35 to 44 years is reached. From then on the rates for the insured exceed those for the general population by considerable margins. This may be attributed probably to the greater hazards to which the wage-earners, as a group, are subject in industrial pursuits.

The following table presents the rates for traumatism by fall for the Industrial policyholders of the five cooperating companies and for the general population of the United States Registration Area (ages one to 74 years) compared for each significant age group:

TABLE 38

Death Rates per 100,000 from Traumatism by Fall Intercompany Industrial Mortality Experience and United States Registration Area, (Ages 1 to 74 years), Compared by Age Periods for Quinquennium 1916 to 1920

AGE PERIODS	Interco. Ind'l.	U. S. Reg. Area	Per cent. Interco. Ind'l. of U. S. Reg. Area
All ages—one and over*.....	10.8	8.6	125.6
1 to 4.....	8.7	7.1	122.5
5 to 9.....	3.5	3.5	100.0
10 to 14.....	2.9	2.8	103.6
15 to 19.....	3.2	2.8	114.3
20 to 24.....	3.8	3.4	111.8
25 to 34.....	5.8	5.2	111.5
35 to 44.....	10.1	8.2	123.2
45 to 54.....	16.5	12.5	132.0
55 to 64.....	30.0	22.6	132.7
65 to 74.....	80.1	57.0	140.5

* Ages 1 to 74 years for U. S. Registration Area.

Comparison of the two experiences year for year, shows that the accidental fall fatality rate in the Intercompany experience was without exception higher than that for the general population. In each experience, however, the mortality showed a pronounced downward trend.

The following table presents for the Industrial policyholders of the five cooperating companies and for the general population of the United States Registration Area, the number of deaths from traumatism by fall and the death rates per 100,000 for each year of the quinquennium, 1916 to 1920:

TABLE 39

Deaths and Death Rates per 100,000 from Traumatism by Fall. Intercompany Industrial Mortality Experience and United States Registration Area (Ages 1 to 74 years) Compared for Period 1916 to 1920

YEAR	DEATH RATES PER 100,000			NUMBER OF DEATHS	
	Interco. Ind'l.	U. S. Reg. Area	Per cent. Interco. of U. S. Reg. Area	Interco. Ind'l.	U. S. Reg. Area
1916-1920	10.8	8.6	125.6	12,342	33,178
1920	9.5	7.1	133.8	2,456	5,925
1919	9.1	7.2	126.4	2,231	5,898
1918	10.4	8.5	122.4	2,381	6,651
1917	11.9	10.2	116.7	2,552	7,361
1916	13.6	10.7	127.1	2,722	7,343
Per cent. decrease 1916-1920	30.1	33.6	....	....	....

(b) Traumatism by Automobile*

The increasing mortality from automobile accidents is an outstanding bad spot in the accident record of the quinquennium 1916 to 1920. The death rate rose continuously throughout the five-year period and the figure for the final year (12.1 per 100,000), is almost 50 per cent. higher than that for the first year (8.1). From the standpoint of this rising tendency, the automobile fatality record is in sharp contrast to those for the four other principal modes of accidental death. In the case of accidental falls, for example, in this insurance experience, the rate declined almost continuously from 13.6 per 100,000 in 1916, to 9.5 in 1920, there being a drop of 30 per cent. Similarly, the accidental drowning death rate fell from 9.7 in 1916 to 6.7 in 1920, or 31 per cent.; the railroad accident figure dropped from 8.6 in 1916 to 6.0 in 1920, or 30 per cent.; and the mortality from accidental burns declined from 8.7 in 1916 to 7.8 in 1920, which is equivalent to a decrease of 10 per cent.

Automobile fatalities* ranked second in numerical importance among accidental causes of death, its total being exceeded very slightly by traumatism by falls. The automobile fatality rate was 10.5 per 100,000 as compared with 10.8 for accidental falls. In the later years of the quinquennium, however, deaths in automobile acci-

* The automobile accidents data in this volume relate to only four of the five cooperating companies, as one of the companies did not make a statistical segregation of deaths due to this cause.

dents exceeded those from falls by considerable margins, and thus, in 1918, 1919 and 1920, motor vehicle fatalities constituted the most important single cause of death in the accident group.

Figures like the above, relating as they do to the wage-earning portion of the American and Canadian populations, supplement those issued by the United States Census Bureau, and relating to the general population. Each set of figures tells the same story of the constantly increasing death toll and emphasizes the fact that the control of automobile accidents is today the outstanding problem of the safety movement. This is obvious, even on the basis of the mortality figures, without taking into account the non-fatal injuries, of which, unfortunately, there is no really full and accurate record. It is known that during the two years subsequent to the period to which this report relates the automobile accident death rate continued to increase. There must be still closer cooperation between the police, the press, the school authorities, the automobile licensing agencies and, above all, between automobile owners and drivers and the general public. There will be no appreciable progress toward the suppression of automobile fatalities until those who drive motor vehicles have a much better realization of their personal responsibility. In most of our cities today there are spots where traffic regulations are broken scores of times daily. The reasonably cautious use of city streets and country roads is a direct and joint responsibility of those who drive motor cars and of the general public.

The increasing importance of automobile accidents as a cause of death is emphasized by the fact that they now outrank most of the infectious diseases. A very few years ago, automobile fatalities were by no means as numerous as deaths from typhoid fever. They were, indeed, outranked by each of the principal infectious diseases of children, measles, scarlet fever, whooping cough and diphtheria. In this experience deaths due to motor-driven vehicles exceeded by a very considerable margin the number due to typhoid fever or to measles; their total was about double the number due to scarlet fever and to whooping cough, and about half that caused by diphtheria. It is, perhaps, even more striking to compare the automobile accident mortality with that due to some of the leading causes of death. There is, for example, one automobile fatality to every six deaths from apoplexy; one to every seven deaths from cancer, and one to every eight deaths from Bright's disease; there is one automobile fatality to every 13 deaths from organic heart disease, one to

every thirteen deaths from pneumonia and one to every 15 deaths from all forms of tuberculosis combined.

In analyzing the mortality due to automobile accidents, we should not lose sight of the fact that the published death rates, large and increasing as they are, do not tell the full story as to the number of persons killed in accidents incidental to the operation of motor-driven vehicles. There are many deaths as the result of collisions between automobiles and railroad engines or trolley cars. Such deaths are not classified in mortality statistics as due to automobile accidents, but in accordance with established rules followed by vital statistics offices, they appear under the headings, "railroad accidents," or "street car accidents." One of the companies, which cooperated in the present study, realizing that a considerable number of deaths occur in such collisions, made an investigation to determine whether or not the automobile accident death rate would be affected to any considerable extent if deaths in these collisions were added to the automobile total. The result was that in a single year this Company found that in addition to 1,642 deaths officially classified as due to automobile traumatisms, there were 65 additional fatalities of those killed in collisions between railroad engines and automobiles; and that 42 other persons died as the result of collisions between trolley cars and automobiles. This company pointed out that if these 107 deaths were added to its total of 1,642 for the year, its death rate for automobile accidents would be increased six and one-half per cent. In all probability, the experience of this Company did not differ materially from that of the others. If this is the case, it is obvious that deaths incidental to the operation of motor-driven vehicles exceed by a considerable margin any other single cause of accidental death.

The following table presents for the Industrial policyholders of the five cooperating companies and for the population of the United States Registration Area, aged one to 74 years, the number of deaths and the death rates per 100,000 from automobile accidents, for each year of the quinquennium 1916 to 1920:

TABLE 40

Deaths and Death Rates per 100,000 from Automobile Accidents. Intercompany Industrial Mortality Experience and United States Registration Area, (Ages 1 to 74 years), Compared for Period 1916 to 1920

YEAR	DEATH RATES PER 100,000			NUMBER OF DEATHS	
	Interco. Ind'l.	U. S. Reg. Area	Per cent. Interco. of U. S. Reg. Area	Interco. Ind'l.	U. S. Reg. Area
1916-1920	10.5	9.0	116.7	11,815	34,686
1920	12.1	10.2	118.6	3,050	8,492
1919	11.5	9.3	123.7	2,761	7,622
1918	10.6	9.1	116.5	2,366	7,124
1917	9.8	8.9	110.1	2,051	6,437
1916	8.1	7.3	111.0	1,587	5,011
Per cent. increase 1916-1920	49.4	39.7	....	....	....

The above table shows for the period as a whole and for each year a considerably higher death rate among the Industrial policyholders than for the general population. This is due to several causes, chief of which are the unfavorable age distribution of the insured (in so far as this relates to the likelihood of being killed in automobile accidents) and the fact that the Industrial policyholders are concentrated in the cities, where the automobile death rate is higher than in the country districts. This phase of the subject may be discussed to better advantage in connection with Table 42 which shows the comparative death rates of the two experiences by age groups.

The following table shows the number of deaths and the death rates per 100,000 Industrial policyholders of the five cooperating companies for all ages combined and for each significant age group during the five-year period, 1916 to 1920:

TABLE 41

Deaths and Death Rates per 100,000 from Automobile Accidents. Intercompany Industrial Mortality Experience 1916 to 1920 By Age Periods

AGE PERIODS	Number of Deaths	Death Rates per 100,000
All ages—one and over	11,815	10.5
1 to 4	1,082	10.6
5 to 9	2,979	19.3
10 to 14	1,519	11.3
15 to 19	844	7.2
20 to 24	789	7.0
25 to 34	1,181	6.4
35 to 44	925	7.2
45 to 54	870	9.1
55 to 64	942	15.1
65 to 74	564	22.4
75 and over	120	22.3

Almost half of all the deaths from automobile accidents (11,815) in this Industrial insurance experience, were those of children. More than a quarter were those in the age group five to nine years, which signifies that they occurred largely as a result of street play. Comparatively few of these children were passengers in automobiles. They died, for the most part, by being run over in the streets of the more congested districts of American and Canadian cities.

In the age groups following those of childhood the death rates were considerably lower and the minimum (6.4 per 100,000) was reached at ages 25 to 34 years. Beginning with the age period 35 to 44 years, the mortality curve again rose and the maximum figures were those for the highest age groups.

The following table presents the rates for automobile accidents for the Industrial policyholders of the five cooperating companies and for the general population of the United States Registration Area (ages one to 74 years) compared for each significant age group:

TABLE 42

Death Rates per 100,000 from Automobile Accidents. Intercompany Industrial Mortality Experience and United States Registration Area, (Ages 1 to 74 years) Compared by Age Periods for Quinquennium 1916 to 1920

AGE PERIODS	Interco. Ind'l.	U. S. Reg. Area	Per cent. Interco. Ind'l. of U. S. Reg. Area
All ages—one and over*.....	10.5	9.0	116.7
1 to 4.....	10.6	7.4	143.2
5 to 9.....	19.3	15.0	128.7
10 to 14.....	11.3	8.1	139.5
15 to 19.....	7.2	5.9	122.0
20 to 24.....	7.0	6.4	109.4
25 to 34.....	6.4	6.6	97.0
35 to 44.....	7.2	7.8	92.3
45 to 54.....	9.1	10.1	90.1
55 to 64.....	15.1	14.8	102.0
65 to 74.....	22.4	18.4	121.7

* Ages 1 to 74 years for U. S. Reg. Area.

Comparison of the death rates of the several age groups, as shown in the above table, brings out, clearly, the following facts: first, the death rate among the insured at all ages exceeds that in the general population by a margin of 17 per cent.; second, the mortality among the children of the wage-earners exceeds that of children in the general population by very large margins, namely, 43 per cent. at ages one to four; 29 per cent. at ages five to nine and 39½ per cent. in the age group 10 to 14 years; third, there is also shown a much higher death rate among insured adolescents; fourth, for some reason, which we are not able to explain, the automobile accident death rate during the main working ages of life, namely, between the ages of 25 and 55 years, is lower among insured wage-earners than for the general population; fifth, in old age the figures are again unfavorable to the insured.

(c) Accidental Drowning

Accidental drowning was third in numerical importance among the causes of accidental death in this Industrial insurance experience, with a death rate of 8.6 per 100,000, based on 9,845 deaths.

Drowning accidents occur, for the most part, in childhood, adolescence and early adult life. Over 38 per cent. of the deaths were those of children between the ages of one and 15 years. At ages five

to nine years, drowning is a more important cause of death than typhoid fever, measles, whooping cough, pulmonary tuberculosis, diarrheal diseases or appendicitis. In the age group, 10 to 14 years, it was actually responsible for four and one-half per cent. of the deaths from all causes combined. Here its mortality was exceeded only by diphtheria, influenza, pneumonia, tuberculosis, heart disease and appendicitis. At these ages it is the leading cause of accidental death. The maximum mortality from accidental drownings among the Industrial policyholders occurred in the age period 15 to 19 years; the death rate remained high between 20 and 25 years; after this the rates were very much lower, but there was a considerable mortality in every age range.

The following table shows the number of deaths from accidental drowning and the death rates per 100,000 Industrial policyholders of the five cooperating companies for all ages combined and for each age group during the five-year period 1916 to 1920:

TABLE 43

Deaths and Death Rates per 100,000 from Accidental Drowning. Intercompany Industrial Mortality Experience, 1916 to 1920 By Age Periods

AGE PERIODS	Number of Deaths	Death Rates per 100,000
All ages—one and over	9.845	8.6
1 to 4	593	5.6
5 to 9	1,548	9.8
10 to 14	1,622	11.8
15 to 19	1,787	14.9
20 to 24	1,279	11.1
25 to 34	1,220	6.5
35 to 44	711	5.4
45 to 54	560	5.8
55 to 64	339	5.3
65 to 74	143	5.6
75 and over	43	7.9

The mortality from this cause among the insured (8.6 per 100,000) was about 21 per cent. in excess of that in the general population (7.1). In eight out of eleven age groups the insured suffered a higher death rate, the exceptions being one to four years, 35 to 44 and 45 to 54 years. The largest excess rate for the insured (37 per cent.) was that recorded for the first period of adult life, 20

to 24 years, followed closely by an excess of 35.5 per cent. at 15 to 19 years; 32.4 per cent. at five to nine years and 24.2 per cent. at ten to fourteen years.

The following table presents the rates for accidental drowning for the Industrial policyholders of the five cooperating companies and for the general population of the United States Registration Area (ages one to 74 years) compared for each significant age group:

TABLE 44

Death Rates per 100,000 from Accidental Drowning. Intercompany Industrial Mortality Experience and United States Registration Area, (Ages 1 to 74 years) Compared by Age Periods for Quinquennium 1916 to 1920

AGE PERIODS	Interco. Ind'l.	U. S. Reg. Area	Per cent. Interco. Ind'l. of U. S. Reg. Area
All ages—one and over*.....	8.6	7.1	121.1
1 to 4.....	5.6	6.8	82.4
5 to 9.....	9.8	7.4	132.4
10 to 14.....	11.8	9.5	124.2
15 to 19.....	14.9	11.0	135.5
20 to 24.....	11.1	8.1	137.0
25 to 34.....	6.5	5.7	114.0
35 to 44.....	5.4	5.8	93.1
45 to 54.....	5.8	5.9	98.3
55 to 64.....	5.3	5.2	101.9
65 to 74.....	5.6	4.7	119.1

* Ages 1 to 74 years for U. S. Reg. Area.

The incidence of accidental drowning showed a pronounced downward tendency, during the period 1916 to 1920, both for the insured and for the general population. The reductions are substantial, as there was a decrease between 1916 and 1920 of 31 per cent. among the insured and of 33 per cent. in the general population. It is entirely possible that much of the credit for the reduction in this class of fatalities should be attributed to the wider application of the principles and practice of water safety advocated by such agencies as the Life Saving Division of the American Red Cross. If local authorities would cooperate more fully with the Red Cross Life Saving Corps in their respective vicinities, it is believed that even greater reductions in the drowning death rate could be accomplished.

Although no data are available to show the mortality from drowning among the five cooperating companies by sex or by season, it is

known that most of the deaths were those of boys, and of young men under 25 years of age. The drowning death rate of males, prior investigations have shown, is about ten times that of females. More drownings occur during the summer months than in all the rest of the year.

The following table presents for the Industrial policyholders of the five cooperating companies and for the general population of the United States Registration Area the number of deaths from accidental drowning and the death rates per 100,000 for each year of the quinquennium 1916 to 1920:

TABLE 45

Deaths and Death Rates per 100,000 from Accidental Drowning. Intercompany Industrial Mortality Experience and United States Registration Area, (Ages 1 to 74 years), Compared for Period 1916 to 1920

YEAR	DEATH RATES PER 100,000			NUMBER OF DEATHS	
	Interco. Ind'l.	U. S. Reg. Area	Per cent. Interco. of U. S. Reg. Area	Interco. Ind'l.	U. S. Reg. Area
1916-1920	8.6	7.1	121.1	9,845	27,123
1920	6.7	5.8	115.5	1,719	4,800
1919	8.7	6.9	126.1	2,130	5,680
1918	9.5	6.8	139.7	2,163	5,318
1917	8.7	7.4	117.6	1,876	5,323
1916	9.7	8.7	111.5	1,957	6,002
Per cent. decrease 1916-1920	30.9	33.3	....	....	....

(d) Burns (conflagration excepted)*

Accidental burns caused 9,759 deaths in this experience, which is equivalent to a death rate of 8.5 per 100,000. Mortality from this cause is heavily concentrated in early childhood. Forty-four per cent. of the deaths were those of children aged one to four years, and 59 per cent. were those of children under ten years of age. Accidental burns were not an important cause of death between the ages of 10 and 55 years, but the rate increased sharply in the higher age groups.

The following table shows the number of deaths from burns and the death rates per 100,000 Industrial policyholders of the five coop-

* Burns resulting from railroad, machinery and mining accidents, as well as those due to electricity and lightning, are classified under other headings.

erating companies for all ages combined and for each age group during the five-year period 1916 to 1920.

TABLE 46

Deaths and Death Rates per 100,000 from Burns (Conflagration Excepted). Intercompany Industrial Mortality Experience, 1916 to 1920 By Age Periods

AGE PERIODS	Number of Deaths	Death Rates per 100,000
All ages—one and over	9,759	8.5
1 to 4	4,315	41.1
5 to 9	1,456	9.2
10 to 14	334	2.4
15 to 19	351	2.9
20 to 24	316	2.8
25 to 34	616	3.3
35 to 44	567	4.3
45 to 54	593	6.1
55 to 64	597	9.4
65 to 74	422	16.5
75 and over	192	35.2

The Intercompany Industrial death rate for burns (8.5 per 100,000) exceeded slightly the figure for the general population of the United States Registration Area (7.5). There are no significant differences in the death rates for the several age periods until age 45 is reached. Beginning with the age group 45 to 54, the mortality was higher among the Industrial policyholders by a very considerable margin for each period.

The following table presents the rates for burns among the Industrial policyholders of the five cooperating companies and for the general population of the United States Registration Area (ages one to 74 years) compared for each significant age group.

TABLE 47

Death Rates per 100,000 from Burns (Conflagration Excepted). Intercompany Industrial Mortality Experience and United States Registration Area, (Ages 1 to 74 years), Compared By Age Periods for Quinquennium 1916 to 1920

AGE PERIODS	Interco. Ind'l.	U. S. Reg. Area	Per cent. Interco. Ind'l. of U. S. Reg. Area
All ages—one and over*.....	8.5	7.5	113.3
1 to 4.....	41.1	38.8	105.9
5 to 9.....	9.2	9.9	92.9
10 to 14.....	2.4	2.7	88.9
15 to 19.....	2.9	2.7	107.4
20 to 24.....	2.8	3.1	90.3
25 to 34.....	3 3	3.3	100.0
35 to 44.....	4.3	3.7	116.2
45 to 54.....	6.1	4.4	138.6
55 to 64.....	9.4	6.5	144.6
65 to 74.....	16.5	10.7	154.2

* Ages 1 to 74 years for U. S. Reg. Area.

A very slight downward tendency of the death rate in both the Intercompany and general population experience is exhibited in Table 48, with higher death rates each year for the insured. Most of the deaths from accidental burns occur in the home. We have noted their heavy incidence in childhood. In the case of these children, the deaths are chargeable for the most part to playing with fire, to scalds, and to the ignition of clothing by grate fires. Accidental burns cause many more deaths among females than among males. In this connection, it should be borne in mind as noted in the footnote on page 72, that burns due to industrial accidents are classified under the several headings relating to such accidents, rather than under that of "burns." If *all* deaths for which burns are responsible were classified as due to burns, it is likely that those of males would be found to predominate. The very slight downward tendency of the death rate during the five-year period shows that there has been small improvement in the high domestic hazard giving rise to deaths from this cause. The accident prevention programme, obviously, should devote more attention to this important cause of death in American and Canadian homes.

The following table presents for the Industrial policyholders of the five cooperating companies and for the general population of the

United States Registration Area, the number of deaths from burns and the death rates per 100,000 for each year of the quinquennium 1916 to 1920.

TABLE 48

Deaths and Death Rates per 100,000 from Burns (Conflagration Excepted). Intercompany Industrial Mortality Experience and United States Registration Area (Ages 1 to 74 Years). Compared for Period 1916 to 1920

YEAR	DEATH RATES PER 100,000			NUMBER OF DEATHS	
	Interco. Ind'l.	U. S. Reg. Area	Per cent. Interco. of U. S. Reg. Area	Interco. Ind'l.	U. S. Reg. Area
1916-1920	8.5	7.5	113.3	9,759	28,945
1920	7.8	7.0	111.4	2,004	5,822
1919	8.1	7.1	114.1	1,985	5,818
1918	8.9	7.7	115.6	2,036	6,032
1917	9.3	8.4	110.7	1,991	6,094
1916	8.7	7.5	116.0	1,743	5,179
Per cent. decrease 1916-1920	10.3	6.7	....	....	....

(e) Railroad Accidents *

We recorded 8,590 deaths of Industrial policyholders from railroad accidents during the period 1916 to 1920, with a death rate of 7.7 per 100,000. The mortality from this cause is at its minimum in childhood and reaches its highest figures in the advanced age groups.

The following table shows the number of deaths from railroad accidents and the death rates per 100,000 Industrial policyholders of the five cooperating companies for all ages combined and for each age group during the five-year period 1916 to 1920.

* The railroad accidents data in this volume relate to only four of the five cooperating companies, as one of the companies did not make a statistical segregation of deaths due to this cause.

TABLE 49

Deaths and Death Rates per 100,000 from Railroad Accidents. Intercompany Industrial Mortality Experience, 1916 to 1920 By Age Periods

AGE PERIODS	Number of Deaths	Death Rates per 100,000
All ages—one and over	8,590	7.7
1 to 4	147	1.4
5 to 9	461	3.0
10 to 14	485	3.6
15 to 19	960	8.2
20 to 24	1,168	10.4
25 to 34	1,824	9.9
35 to 44	1,199	9.3
45 to 54	987	10.3
55 to 64	845	13.5
65 to 74	413	16.4
75 and over	101	18.7

The death rate for this cause has been exhibiting for a number of years a pronounced downward tendency. During the period to which this report relates there was a decline of 30 per cent. in the Intercompany Industrial experience, and of 36 per cent. in that of the general population on the basis of comparison between the figures for the first and final years.

For the five-year period as a whole, for each of the separate years, the death rate of the general population exceeded that of the insured.

The following table presents for the Industrial policyholders of the five cooperating companies and for the general population of the United States Registration Area, the number of deaths from railroad accidents and the death rates per 100,000 for each year of the quinquennium 1916 to 1920.

TABLE 50

Deaths and Death Rates per 100,000 from Railroad Accidents. Intercompany Industrial Mortality Experience and United States Registration Area (Ages 1 to 74 Years). Compared for Periods 1916 to 1920

Year	Death Rates per 100,000			Number of Deaths	
	Interco. Ind'l.	U. S. Reg. Area	Per cent. Interco. of U. S. Reg. Area	Interco. Ind'l.	U. S. Reg. Area
1916-1920	7.7	9.4	81.9	8,590	36,253
1920	6.0	7.3	82.2	1,506	6,068
1919	6.2	7.4	83.8	1,485	6,041
1918	9.0	10.3	87.4	2,026	8,104
1917	9.0	11.4	78.9	1,879	8,225
1916	8.6	11.4	75.4	1,694	7,815
Per cent. decrease 1916-1920	30.2	36.0	....	....	....

(f) War Deaths

Deaths from "External Causes" (or those which result from injury due to violence, in contradistinction to those which are dependent upon pathological processes within or upon the body) are classified in times of peace under three general headings: suicide, homicide and accident. There is, however, a fourth class which is very important in this report. We refer to deaths resulting from injuries sustained during the World War. Such injuries although resulting, for the most part, like homicide, from the impulse of persons to kill each other, must for obvious reasons, be distinguished from homicide in a statistical report.*

Of the five cooperating companies, only three kept records of the deaths definitely due to war injuries. Two of the companies reported "war deaths" with "other external violence" (International List Title No. 186). It was necessary, therefore, to estimate the number of such deaths. This was done on the assumption that the ratio of war deaths to the mortality from "other external violence" was the same in the two companies which did not specify these war deaths separately as it was for those that did. On this basis, there were 20,202 "war deaths" during the

* As a matter of fact, deaths from battle wounds, according to standard classification practice, are included in the accident total.

quinquennium, at a rate of 17.6 per 100,000. It is further estimated that 1,792 of these occurred in 1916; 2,712 in 1917; 10,640 in 1918; 4,874 in 1919; and 184 in 1920.

The following table shows the estimated number of deaths and the death rates per 100,000 from "war deaths" among the Industrial policyholders of the five cooperating companies during the five year period 1916 to 1920 by significant age groups:

TABLE 51

Deaths and Death Rates per 100,000 from "War Deaths" Intercompany Industrial Mortality Experience 1916 to 1920 By Age Periods

AGE PERIODS	Number of Deaths	Death Rates per 100,000
All ages—one and over	20,202	17.6
1 to 4	....	...
5 to 9	1	...
10 to 14	....	...
15 to 19	2,492	20.7
20 to 24	8,816	76.8
25 to 34	7,532	40.1
35 to 44	1,217	9.3
45 to 54	120	1.2
55 to 64	11	.2
65 to 74	13	.5
75 and over	....	...

The above table shows, as would be expected, a distinct concentration of such deaths between the ages of 20 and 35 years.

It is obvious that "war deaths" were an important cause of death numerically. Their total is substantially one-quarter of that for all forms of accident (83,891). It exceeds by one-third the combined total for suicides and homicides. We have included only such "war deaths" as arose out of injuries. If we were to include the deaths of those serving in the world war caused by disease the total would be greatly augmented. As it is, the total of 20,202 is more than twice the death toll of typhoid fever during the quinquennium and exceeds by large margins the mortality from such important causes of death as diabetes, arterial diseases, appendicitis and cirrhosis of the liver.

There are no data showing what proportion of these "war deaths" occurred overseas and in the United States and Canada; nor is

information available as to the nature of wounds causing death, or the number of fatal injuries sustained in actual battle, in concentration camps, or in other operations incidental to the conduct of the War.

IX. SUICIDE

Suicide accounted for the deaths of 10,241 policyholders of the five cooperating companies during the five-year period 1916 to 1920. The death rate was 8.9 per 100,000. Deaths were classified under this heading only in cases where the fact of suicide was established. In all cases where the suicidal character of the death was in doubt, the case was classified as "accidental or unqualified." It should be noted, however, that every effort was made (when indefinite reports like "poisoning," drowning," "inhalation of gas," and others, were encountered) to determine whether the death was accidental, suicidal or homicidal. The probability is that very few deaths from suicide failed of identification as such and that the above figures are very close approximations of the suicide mortality among the Industrial policyholders. The 10,241 suicides constituted a little less than 0.8 per cent. of the mortality from all causes.

Although 66 deaths of children were recorded, suicide did not begin to assume importance as a cause of death until the period of adolescence (15 to 19 years) was reached. In this age group, 516 deaths were registered with a death rate of 4.3 per 100,000. From this age period up to ages 75 and over a rising death rate was recorded among the Industrial policyholders.

The following table shows the number of deaths from suicide and the death rates per 100,000 Industrial policyholders of the five cooperative companies, for all ages combined, and for each significant age group during the five-year period 1916 to 1920:

TABLE 52

Deaths and Death Rates per 100,000 from Suicide. Intercompany Industrial Mortality Experience, 1916 to 1920 By Age Periods

AGE PERIODS	Number of Deaths	Death Rates per 100,000
All ages—one and over	10,241	8.9
1 to 4	....	...
5 to 9	3	...
10 to 14	63	.5
15 to 19	516	4.3
20 to 24	1,038	9.0
25 to 34	2,354	12.5
35 to 44	2,075	15.8
45 to 54	1,900	19.6
55 to 64	1,441	22.6
65 to 74	669	26.1
75 and over	182	33.4

The suicide death rate declined materially and continuously during the five year period, both among the insured and in the general population. This is shown by the table on page 81. In two of these five years the country was at war; two later years constituted a short post-war period. In the first war year, 1917, there was a slight drop in the suicide death rate, and this was followed by a more pronounced decline in 1918. The decreases in the two following years were not quite so great. Several factors probably operated in causing lower suicide mortality during the war and the immediate post-war period. One, undoubtedly, was the opportunity for war service which presented itself to practically the whole population, male and female, of nearly all ages. There is no question but that the several forms of war activities, both at home and abroad, had a tendency to deflect from morbid channels the minds of many persons who might have been, otherwise, more or less inclined to self-destruction. Another factor was the improved economic status of both the wage-earners and the general population. This obtained both during the war and the two years immediately following it. There can be no doubt that the suicide death rate is affected materially by favorable or unfavorable economic conditions. Already there are indications that the 1921 suicide figures, when published, will show a pronounced increase in the mortality. Early in 1921, the *National Committee for Mental Hygiene* called attention to a marked increase in the number of suicides, especially among ex-soldiers. Nineteen twenty-

one was a year in which general prosperity was far below the average for the quinquennium, 1916 to 1920. This probably resulted in an increased suicide rate, which will be reflected by the figures for the general population, as well as by those for the Industrial policyholders.

The decline in the suicide death rate during the quinquennium was slightly more pronounced for the wage-earners than for the general population. In the case of the former, the 1920 death rate was 33.6 per cent. lower than the rate for 1916; the corresponding per cent. decline for the general population was 28.9.

The following table presents for the Industrial policyholders of the five cooperating companies and for the population of the Registration Area, aged one to 74 years, the number of deaths from and the death rates for suicide for each year of the quinquennium 1916 to 1920:

TABLE 53

Deaths and Death Rates per 100,000 from Suicide. Intercompany Industrial Experience and United States Registration Area (Ages 1 to 74 Years). Compared For the Period 1916 to 1920

YEAR	DEATH RATES PER 100,000			NUMBER OF DEATHS	
	Interco. Ind'l.	U. S. Reg. Area	Per cent. Interco. of U. S. Reg. Area	Interco. Ind'l.	U. S. Reg. Area
1916-1920	8.9	12.0	74.2	10,241	46,284
1920	7.3	10.1	72.3	1,895	8,419
1919	8.0	11.3	70.8	1,947	9,287
1918	8.7	11.8	73.7	1,994	9,237
1917	10.2	13.2	77.3	2,187	9,564
1916	11.0	14.2	77.5	2,218	9,777
Per cent. decrease 1916-1920	33.6	28.9	....	....	....

The above table brings out the interesting fact that the suicide death rate is much higher for the general population than for the Industrial group. This applies to each individual year of the five year period as well as to the period as a whole.

Analysis of the death rate by age groups shows also that in every case where suicide is important as a cause of death the mortality was higher in the general population than in the Industrial group. These figures are in sharp contrast to those brought out by a prior

study of this subject made by one of the contributing companies and relating to the six year period 1911 to 1916. In this prior study the figures showed that for all of the age groups from 25 years upward there were higher suicide rates in the Industrial group than were in evidence for the general population. It appears that during the years preceding the intense industrial activity incident to the World War, the wage-earners took their own lives to a much greater extent than in the years of greater prosperity incidental to the War and immediate post-war period.

The following table presents the rates for suicide for the Industrial policyholders of the five cooperating companies and for the general population of the United States Registration Area (ages one to 74 years) compared for each significant age period:

TABLE 54

Death Rates per 100,000 from Suicide. Intercompany Industrial Mortality Experience and United States Registration Area (Ages 1 to 74 Years) Compared By Age Periods for Quinquenium 1916 to 1920

AGE PERIODS	Interco. Ind'l.	U. S. Reg. Area	Per cent. Interco. Ind'l. of U. S. Reg. Area
All ages—one and over*.....	8.9	12.0	74.2
1 to 4.....	....	....	....
5 to 9.....	....	....	....
10 to 14.....	.5	.5	100.0
15 to 19.....	4.3	4.3	100.0
20 to 24.....	9.0	9.1	98.9
25 to 34.....	12.5	14.0	89.3
35 to 44.....	15.8	18.4	85.9
45 to 54.....	19.6	23.9	82.0
55 to 64.....	22.6	31.1	72.7
65 to 74.....	26.1	31.8	82.1

* Ages 1 to 74 years for U. S. Reg. Area.

X. HOMICIDE †

Four thousand, one hundred and sixty-one deaths among the wage-earners and their families insured in the five cooperating com-

† Under homicide in this report are classified only those cases in which the fact of homicide, or an attempt at homicide is clearly shown. In every instance where the homicidal character of the death was in doubt, the case was classified as "accidental or unqualified." It should be noted, however, that every effort was made (when any indefinite reports like "gun shot wound," "knife wound" and others were encountered) to determine whether the death was accidental, suicidal or homicidal. It is not probable that many deaths actually due to homicide failed of identification as such, and it is believed that the number of deaths and the corresponding death rates shown for this cause are very close approximations of the homicide mortality among the Industrial policyholders.

panies were classified as homicides. The death rate was 3.6 per 100,000.

Deaths from homicide in this Industrial insurance experience were concentrated largely between the ages of 20 and 45 years. Two-thirds of the mortality was that of persons in these age periods of early adult and middle life, while one-third of the deaths were those of persons between 25 and 35 years of age. The Census Bureau mortality reports show about the same age distribution for the homicide mortality in the general population.

The following table shows the number of deaths from homicide and the death rates per 100,000 Industrial policyholders of the five cooperating companies for all ages combined and for each significant age group during the five year period 1916 to 1920:

TABLE 55

Death Rates per 100,000 from Homicide. Intercompany Industrial Mortality Experience, 1916 to 1920 By Age Periods

AGE PERIODS	Number of Deaths	Death Rates per 100,000
All ages—one and over	4,161	3.6
1 to 4	86	.8
5 to 9	120	.8
10 to 14	96	.7
15 to 19	417	3.5
20 to 24	732	6.4
25 to 34	1,249	6.6
35 to 44	788	6.0
45 to 54	408	4.2
55 to 64	187	2.9
65 to 74	66	2.6
75 and over	12	2.2

The homicide death rate showed no improvement during the period 1916 to 1920, either for the wage-earners or for the general population. As a matter of fact there has probably been little change in the homicide situation among the Industrial policyholders during the last decade. A study of the subject made by one of the contributing companies, and relating to its Industrial policyholders, covered the ten year period 1911 to 1920, and showed a very slight decline in the homicide death rate during the quinquennium 1916 to 1920 as compared with 1911 to 1916. This decline was due to

below-average homicide mortality in two of the years of the later quinquennium, 1918 and 1920; but in two other years of the same five year period the homicide death rate was about equal to the average for the five years 1911 to 1915, while for 1917 the figure was actually higher than for any year of the whole decade. Figures for the general population extending back to 1900, when analyzed with due regard for all of the facts connected with the reporting and classification of violent deaths, show that there has been little, if any improvement in the general population homicide situation within the past twenty years. It is true that for a few of the earlier years the published homicide death rates were very much lower than those which appeared in the Census mortality reports for later years. The low published figures for the first few years of the decade 1900 to 1909, were due, largely, to poor reporting of violent deaths and do not present a true picture of the homicide mortality of that time. Along about 1905 the Census Bureau began to question the reliability of such reports of cause of death as "gun shot wound," "poisoning" and "knife wound," and the fact was immediately disclosed that hundreds of such cases belonged in the homicide class rather than in the "accidental or unqualified" total under which they had been tabulated for years. The result was that the published death rate rose sharply and in two or three years homicide mortality figures were published which differ very little from those which appeared fifteen years later. The homicide death rates for the insured we believe to be uniformly reliable, and comparable with the facts for the United States Registration Area within recent years.

The following table presents for the Industrial policyholders of the five cooperating companies and for the population of the Registration Area aged one to 74 years the number of deaths from and the death rates for homicide for each year of the quinquennium 1916 to 1920:

TABLE 56

Deaths and Death Rates per 100,000 from Homicide. Intercompany Industrial Mortality Experience and United States Registration Area (Ages 1 to 74 Years), Compared for Period 1916 to 1920

YEAR	DEATH RATES PER 100,000			NUMBER OF DEATHS	
	Interco. Ind'l.	U. S. Reg. Area	Per cent. Interco. of U. S. Reg. Area	Interco. Ind'l.	U. S. Reg. Area
1916-1920	3.6	7.1	50.7	4,161	27,333
1920	3.4	6.7	50.7	887	5,592
1919	3.8	7.5	50.7	918	6,130
1918	3.4	6.7	50.7	774	5,241
1917	3.8	7.7	49.4	814	5,535
1916	3.8	7.0	54.3	768	4,835
Per cent. decrease 1916-1920	10.5	4.3	....	....	....

The figures in the above table should not be used as indicating the relative mortality from homicide among the wage-earners and in the general population. It should be borne in mind that the figures for the former relate to a white exposure, whereas those for the latter are based on an exposure in which there is a considerable proportion of colored persons. The homicide rate for the colored greatly exceeds that for the white; in fact it is about ten times as high.

The following table presents the rates for homicide for the Industrial policyholders of the five cooperating companies and for the general population of the United States Registration Area (ages one to seventy-four years) compared for each significant age group:

TABLE 57

Death Rates per 100,000 from Homicide.
Intercompany Industrial Mortality Experience and United States Registration Area (Ages 1 to 74 Years), Compared by Age Periods for Quinquennium 1916 to 1920

AGE PERIODS	Interco. Ind'l.	U. S. Reg. Area	Per cent. Interco. Ind'l. of U. S. Reg. Area
All ages—one and over*.....	3.6	7.1	50.7
1 to 4.....	.8	1.0	80.0
5 to 9.....	.8	.8	100.0
10 to 14.....	.7	1.0	70.0
15 to 19.....	3.5	5.0	70.0
20 to 24.....	6.4	10.7	59.8
25 to 34.....	6.6	13.1	50.4
35 to 44.....	6.0	11.7	51.3
45 to 54.....	4.2	8.1	51.9
55 to 64.....	2.9	5.2	55.8
65 to 74.....	2.6	3.6	72.2

* Ages 1 to 74 years for U. S. Reg. Area.

XI. CANCER

Cancer and other malignant growths caused 82,610 deaths among the Industrial policyholders of the five companies cooperating in this report. This corresponds to a death rate of 72.0 per 100,000. Cancer was the seventh cause of death in numerical importance, those with higher rates being tuberculosis, pneumonia, heart disease, influenza, Bright's disease and accidents in the order named. The various forms of malignant tumors classified under the generic term "cancer" caused 6.2 per cent. of the total deaths from all causes among these Industrial policyholders.

Although cancer is not numbered among the important causes of death in the earlier age groups, the records show that even in childhood there is a considerable mortality. The type of malignant growth known as "sarcomata" is responsible for most of the deaths of young children which are recorded under the heading of "cancer." Beginning with ages 35 to 44 years cancerous tumors become a very important cause of death and from this period the death rate increases with each higher age group. At ages 35 to 44 years there were 9,784 deaths in this insurance experience with a death rate of 74.5 per 100,000 exposed. This is 6.4 per cent. of the total mortality of this age group. Only four diseases had higher death rates at this age period during the quinquennium 1916-1920: tuberculosis,

pneumonia, influenza and organic heart disease. In three of the five years namely, 1916, 1917, and 1920 the cancer mortality in this age group far exceeded that of influenza. At ages 45 to 54 there was a sharp increase in the cancer death rate to 205.0, a figure which is almost triple that of the next lower age group. At these ages 19,914 deaths occurred, which is 12 per cent. of the mortality from all causes among the Industrial policyholders at this period of life. Here the death rate for cancer exceeds that of influenza and of pneumonia. Tuberculosis with a rate of 235.6 and organic heart disease (206.0) are the only conditions whose mortality was higher than that for cancer. In the age group 55 to 64 years, malignant growths caused the deaths of 25,585 Industrial policyholders of the five companies. This is equivalent to a death rate of 400.9 per 100,000. In this group organic heart disease is the only cause of death charged with higher mortality than cancer. The cancer death rate here exceeded that for influenza and pneumonia combined. These 25,585 deaths constituted 12.9 per cent. of the mortality from all causes at these ages. In the age group 65 to 74 years the recorded number of deaths from cancer was 17,130 and the death rate was 668.3 per 100,000. Here cancer ranks as the fourth cause of death in numerical importance, with organic heart disease the first, Bright's disease the second, and cerebral hemorrhage the third. The 17,130 deaths constituted 9.9 per cent. of the mortality from all causes at ages 65 to 74. In the highest age group, 75 years and over, 5,493 deaths were recorded with a death rate of 1006.6 per 100,000. Among the causes of death for this period of extreme old age cancer ranks sixth, being exceeded by the figures for heart disease, cerebral hemorrhage, Bright's disease, pneumonia and arterial disease. It caused 6.3 per cent. of the total mortality in this age group.

The following table shows the number of deaths from cancer and the death rates per 100,000 industrial policyholders of the five cooperating companies for all ages combined and for each age group during the five year period 1916—1920:

TABLE 58

Deaths and Death Rates per 100,000 from Cancer. Intercompany Industrial Mortality Experience, 1916 to 1920 By Age Periods

AGE PERIODS	Number of Deaths	Death Rates per 100,000
All ages—one and over	82,610	72.0
1 to 4	377	3.6
5 to 9	271	1.7
10 to 14	206	1.5
15 to 19	337	2.8
20 to 24	515	4.5
25 to 34	2,998	16.0
35 to 44	9,784	74.5
45 to 54	19,914	205.0
55 to 64	25,585	400.9
65 to 74	17,130	668.3
75 and over	5,493	1006.6

The incidence of cancer among the Industrial policyholders is very similar to that of the general population of the United States. The death rates for each year of the five year period are substantially alike; nor is there in either experience any evidence of either an upward or downward tendency in the mortality. The most outstanding and discouraging facts brought out in both experiences, indeed, are that there has been no improvement in recent years with respect to the cancer death rate, and that this is true not only of the population in general, but of the wage-earning group living in the cities. There has been much controversy for a decade or more as to whether or not the cancer death rate is increasing. It is contended on the one hand, that the published death rates for several decades clearly indicate a rising mortality, and on the other, that these published figures, although on their face suggesting such increase, really present a false picture of actual conditions owing to the influence of such factors in later years as better diagnoses and more accurate reporting of causes of death. The death rates in this report are restricted, of course, to a five year period; but they are very valuable indices to what has happened during that time. They certainly do not suggest any significant movement of the cancer mortality—either upward or downward—in the recent years.

Another important development which is brought out by comparison of the death rates of the general population with those of the insured wage-earners is that the experience of these five years

indicates a close association between low economic status and a high cancer death rate. What small differences appear in the rates shown in the first table below are more favorable to the general population than to the wage earners and their families. In the second table, where comparisons are given by age-groups, the figures show clearly that in each age-period of high cancer mortality, there is a considerable excess in the death rate of the Industrial policyholders.

The following table presents for the Industrial policyholders of the five cooperating companies and for the population of the United States Registration Area, aged one to seventy-four years, the death rates for cancer for each year of the quinquennium 1916-1920:

TABLE 59

Deaths and Death Rates per 100,000 from Cancer. Intercompany Industrial Mortality Experience and United States Registration Area (Ages 1 to 74 Years), Compared for Period 1916 to 1920

YEAR	DEATH RATES PER 100,000			NUMBER OF DEATHS	
	Interco. Ind'l.	U. S. Reg. Area	Per cent. Interco. of U. S. Reg. Area	Interco. Ind'l.	U. S. Reg. Area
1916-1920	72.0	71.9	100.1	82,610	276,598
1920	75.0	72.7	103.2	19,336	60,339
1919	69.5	70.7	98.3	17,011	58,008
1918	69.0	71.0	97.2	15,791	55,700
1917	72.6	72.6	100.0	15,576	52,507
1916	74.2	72.8	101.9	14,896	50,044
Per cent. increase 1916-1920	1.1	.1*	....	....	....

* Decrease.

The following table presents the death rates for cancer for the Industrial policyholders of the five cooperating companies and for the general population of the United States Registration Area, compared for each significant age group:

TABLE 60

Death Rates per 100,000 from Cancer. Intercompany Industrial Mortality Experience and United States Registration Area (Ages 1 to 74 Years), Compared by Age Periods for Quinquennium 1916 to 1920

AGE PERIODS	Interco. Ind'l.	U. S. Reg. Area	Per cent. Interco. Ind'l. of U. S. Reg. Area
All ages—one and over*	72.0	71.9	100.1
1 to 4	3.6	3.5	102.9
5 to 9	1.7	1.8	94.4
10 to 14	1.5	1.7	88.2
15 to 19	2.8	2.8	100.0
20 to 24	4.5	4.7	95.7
25 to 34	16.0	14.7	108.8
35 to 44	74.5	57.6	129.3
45 to 54	205.0	161.4	127.0
55 to 64	400.9	357.8	112.0
65 to 74	668.3	593.0	112.7

* Ages 1 to 74 years for U. S. Reg. Area.

XII. CEREBRAL HEMORRHAGE, APOPLEXY

Cerebral hemorrhage with 71,972 deaths and a death rate of 62.8 per 100,000 was eighth in importance among the causes of death in the experience of the Industrial policyholders of the five cooperating companies. The seven causes for which higher death rates were recorded are tuberculosis, pneumonia, organic heart disease, influenza, Bright's disease, accidents and cancer. In three of the five years, namely, 1916, 1917 and 1920, cerebral hemorrhage was responsible for many more deaths than was influenza, and in all non-epidemic years may be rated as the seventh cause in numerical importance. At all ages cerebral hemorrhage caused 5.4 per cent. of the total mortality.

This disease begins to assume importance as a cause of death in the age group 35 to 44 years. In this period, 3,505 deaths of Industrial policyholders were charged to it and its death rate was 26.7 per 100,000. The rate from this age group on through the higher periods rose sharply in each instance. The figure for ages 45 to 54 (109.4 per 100,000) was more than four times that recorded for ages 35 to 44; for the age period 55 to 64 the death rate was 327.3 per 100,000 which was three times that for the age group 45 to 54 years; at 65 to 74 the mortality rose to 893.1 which is substantially two and three-quarter times the figure for the next lowest

age group; and in extreme old age, 75 years and over, the recorded rate of 2237.7 per 100,000 was two and one-half times that registered for the ages 65 to 74 years.

Thus, after 45 years of age cerebral hemorrhage assumes a very considerable importance among the causes of death. The 10,630 fatal cases in the age group 45 to 54 years constituted 6.4 per cent. of all the mortality at these ages. Here cerebral hemorrhage ranks sixth among the causes of death, being exceeded by tuberculosis, heart disease, cancer, Bright's disease and pneumonia which rank in the order named. In the age group 55 to 64 years the 20,892 deaths recorded made cerebral hemorrhage the fourth cause in numerical importance, as it was outranked by only organic heart disease, cancer and Bright's disease. At ages 65 to 74 years the number of deaths charged to cerebral hemorrhage was 22,891, and in this age group it was the third cause in numerical importance, being outranked by organic heart disease and Bright's disease only. In the highest age group cerebral hemorrhage ranked as the second cause of death, organic heart disease being the only disease with a higher death rate.

The following table shows the number of deaths and the death rates per 100,000 Industrial policyholders of the five cooperating companies for all ages combined and for each significant age group during the five year period 1916 to 1920:

TABLE 61

Deaths and Death Rates per 100,000 from Cerebral Hemorrhage. Intercompany Industrial Mortality Experience, 1916 to 1920 By Age Periods.

AGE PERIODS	Number of Deaths	Death Rates per 100,000
All ages—one and over	71,972	62.8
1 to 4	193	1.8
5 to 9	79	.5
10 to 14	77	.6
15 to 19	160	1.3
20 to 24	249	2.2
25 to 34	1,085	5.8
35 to 44	3,505	26.7
45 to 54	10,630	109.4
55 to 64	20,892	327.3
65 to 74	22,891	893.1
75 and over	12,211	2237.7

Although in this and all other mortality experiences there has been recorded a considerable number of deaths from cerebral hem-

orrhage among persons below the age of 45 years, it is fairly certain that very few deaths at these ages are properly chargeable to this condition. A report of "cerebral hemorrhage" or "apoplexy" is one whose accuracy is subject to grave doubt at any age, but it is especially open to question if returned as the cause of death of a person under fifty. As a matter of fact, it is more than probable that in a large majority of such deaths the brain hemorrhages are only secondary or terminal manifestations of cerebral syphilis. Sir William Osler* in analyzing the mortality returns of the Registrar-General of England and Wales refers to 3,713 deaths of persons between the ages of 25 and 50 reported as caused by cerebral hemorrhage, and states that of these "3,000 can be claimed as due to syphilis." Dr. Osler was also very doubtful as to the correctness of the reports of cerebral hemorrhage for many deaths of persons over the age of 50, and expressed his attitude as to these rather facetiously in the statement that beyond that age "It is the privilege of any man to rupture a blood vessel in his brain without suspicion." The published death rates for cerebral hemorrhage are increased considerably by large numbers of cases certified by coroners or coroner's physicians in instances where death is sudden and the case is seen only after death.

There has been no pronounced upward or downward tendency in the cerebral hemorrhage death rate during the five years covered by this report. This applies to both the Industrial policyholders and to the general population and is clearly shown in the table below.

The following table presents for the Industrial policyholders of the five cooperating companies and for the population of the United States Registration Area, aged one to seventy-four years, the number of deaths and the death rates per 100,000 for cerebral hemorrhage for each year of the quinquennium 1916 to 1920:

* Annual Oration on the Campaign Against Syphilis, delivered before the Medical Society of London, May 14, 1917. The Lancet, May 26, 1917.

TABLE 62

Deaths and Death Rates per 100,000 from Cerebral Hemorrhage. Intercompany Industrial Mortality Experience and United States Registration Area (Ages 1 to 74 Years), Compared for Period 1916 to 1920

Year	Death Rates per 100,000			Number of Deaths	
	Interco. Ind'l.	U. S. Reg. Area	Per cent Interco. of U. S. Reg. Area	Interco. Ind'l.	U. S. Reg. Area
1916-1920	62.8	56.8	110.6	71,972	218,423
1920	63.5	55.9	113.6	16,376	46,360
1919	57.2	54.1	105.7	13,988	44,412
1918	61.3	57.0	107.5	14,034	44,725
1917	63.6	59.3	107.3	13,645	42,870
1916	69.3	58.2	119.1	13,929	40,056
Per cent. decrease 1916-1920	8.4	4.0	....	....	....

The above table shows higher rates each year among the wage-earners than among the general population aged one to seventy-four years. These higher rates prevailed at all of the important age-periods, as shown by the following table:

TABLE 63

Death Rates per 100,000 from Cerebral Hemorrhage. Intercompany Industrial Mortality Experience and United States Registration Area (Ages 1 to 74 Years), Compared by Age Periods for Quinquennium 1916 to 1920

Age Periods	Interco. Ind'l.	U. S. Reg. Area	Per cent. Interco. Ind'l. of U. S. Reg. Area
All ages—one and over*	62.8	56.8	110.6
1 to 4	1.8	1.7	105.9
5 to 9	.5	.9	55.6
10 to 14	.6	.8	75.0
15 to 19	1.3	1.6	81.3
20 to 24	2.2	2.4	91.7
25 to 34	5.8	6.1	95.1
35 to 44	26.7	23.6	113.1
45 to 54	109.4	90.0	121.6
55 to 64	327.3	279.1	117.3
65 to 74	893.1	713.8	125.1

* Ages 1 to 74 years for U. S. Reg. Area.

XIII. FOUR COMMUNICABLE DISEASES OF CHILDHOOD (MEASLES, SCARLET FEVER, WHOOPING COUGH AND DIPHTHERIA)

The four communicable diseases of childhood including measles, scarlet fever, whooping cough and diphtheria, together caused 47,122 deaths during the period 1916 to 1920, or 3.5 per cent. of the total mortality. This total brings the group well forward in the list of principal causes. Much interest attaches to these conditions because of the important part which children under age fifteen play in the field of Industrial insurance, constituting as they do fully one-third of all the insured. In the age-range 1 to 14 years these four important communicable diseases caused 21 per cent. of the total mortality. The following table is instructive:

TABLE 64

Number of Deaths from Four Principal Communicable Diseases of Children, and Percentage of Total Deaths at Ages 1 to 14 Years
Intercompany Industrial Mortality Experience, 1916 to 1920

CAUSES OF DEATH	Deaths	Per cent. of total	Death Rate per 100,000
All causes	218,360	100.0	545.2
Measles	8,637	4.0	21.6
Scarlet fever	5,022	2.3	12.5
Whooping cough	6,114	2.8	15.3
Diphtheria and croup	24,991	11.4	62.4

Industrial policyholders are moreover largely concentrated in the cities, where these diseases prevail to a greater extent than in the rural areas. These diseases, therefore, play a larger part in the total mortality of the insured than in the general population.

Before entering upon a detailed discussion of each of the diseases, it is purposed to show comparatively the age distribution of the deaths for each of these important communicable diseases of children, as in the following table:

TABLE 65

Proportion of Deaths from Each of Four Principal Diseases of Children in Age Periods Under Twenty Years of Age. Intercompany Industrial Mortality Experience, 1916 to 1920

Age Period	Percentage of Total, All Ages One and Over				Number of Deaths			
	Measles	Scarlet Fever	Whooping cough	Diphtheria	Measles	Scarlet Fever	Whooping cough	Diphtheria
All ages—one and over	100.0	100.0	100.0	100.0	9,051	5,698	6,167	26,206
1 to 4	78.0	45.3	89.1	52.4	7,060	2,582	5,495	13,731
5 to 9	15.1	33.2	9.6	35.7	1,365	1,894	591	9,363
10 to 14	2.3	9.6	.5	7.2	212	546	28	1,897
15 to 19	1.4	4.5	.3	1.7	123	257	16	443
20 or over	3.2	7.4	.6	2.9	291	419	37	772

Whooping cough tends to concentrate heavily upon the earliest age period in life, followed in this tendency by measles, diphtheria and scarlet fever. The last disease shows a marked dispersion over the whole age-range under twenty years, more so than any one of the other three diseases. More than seven per cent. of the deaths from scarlet fever in this present experience were recorded at ages above twenty years.

(a) Measles

Measles caused 9,051 deaths among the Industrial policyholders of the five cooperating companies at a rate of 7.9 per 100,000 exposed. This disease is an important cause of mortality during the first decade of life. Over 93 per cent. of the deaths from this disease were those of children between the ages of one and ten years; seventy-eight per cent. occurred between one and four years. Thus, 5.6 per cent. of all of the deaths of insured children aged one to four years and 4.6 per cent. of the deaths of those under ten years of age were due to this disease. It ranked as the second cause of death among the four principal diseases of childhood, being exceeded by diphtheria alone. Its death rate at all ages (7.9 per 100,000) was 58 per cent. higher than that for scarlet fever (5.0), and 46 per cent. in excess of that for whooping cough (5.4). Its death rate for the age period one to four years (67.2) was over one-half that for diphtheria at the same ages (130.8); it was about two and three-quarter times the rate for scarlet fever at this age (24.6) and over one and one-quarter times the whooping cough rate for the same age group (52.3).

The mortality from measles shows fluctuations from year to year. It cannot be said that either in the experience of the five cooperating companies or in that of the United States Registration Area there has been much of a downward trend during the quinquennium covered by this report.

Comparison of the death rates, year by year, among the Industrial policyholders and the general population show that with one exception the rate was higher among the insured. There are excellent reasons to expect this result. In the first place, measles is a disease which consistently, year after year, has shown higher death rates in cities than in rural communities. As children insured in the Industrial Departments of the five cooperating companies are almost all residents of cities, this fact alone would lead us to expect higher rates among the insured. Again, there is found in the insured group a higher ratio of young children of the age periods where measles is most fatal.

The following table gives the death rates for measles for each year of the five year period among insured white persons of the five cooperating companies and among the population of the Registration Area:

TABLE 66

Deaths and Death Rates per 100,000 from Measles. Intercompany Industrial Mortality Experience and United States Registration Area (Ages 1 to 74 Years), Compared for Period 1916 to 1920

YEAR	DEATH RATES PER 100,000			NUMBER OF DEATHS	
	Interco. Ind'l.	U. S. Reg. Area	Per cent. Interco. of U. S. Reg. Area	Interco. Ind'l.	U. S Reg. Area
1916-1920	7.9	7.4	106.8	9,051	28,358
1920	8.4	7.0	120.0	2,171	5,768
1919	3.3	3.0	110.0	805	2,456
1918	8.3	7.9	105.1	1,907	6,233
1917	9.8	11.1	88.3	2,112	8,011
1916	10.2	8.6	118.6	2,056	5,890
Per cent. decline 1916-1920	17.6	18.6	....	....	....

The following table presents the death rates for measles for the Industrial policyholders of the five cooperating companies and for the general population of the United States Registration Area (ages one to 74 years), compared for each significant age group.

TABLE 67

Death Rates per 100,000 from Measles. Intercompany Industrial Mortality Experience and United States Registration Area (Ages 1 to 74 Years), Compared by Age Periods for Quinquennium 1916 to 1920

AGE PERIODS	Interco. Ind'l.	U. S. Reg. Area	Per cent. Interco. Ind'l. of U. S. Reg. Area
All ages—one and over*.....	7.9	7.4	106.8
1 to 4.....	67.2	58.1	115.7
5 to 9.....	8.6	8.9	96.6
10 to 14.....	1.5	3.0	50.0
15 to 19.....	1.0	3.1	32.3
20 to 24.....	.7	2.0	35.0
25 to 34.....	.5	1.2	41.7
35 to 44.....	.4	1.3	30.8
45 to 54.....	.4	1.3	30.8
55 to 64.....	.3	1.4	21.4
65 to 74.....	.3	2.1	14.3

* Ages 1 to 74 years for U. S. Reg. Area.

The excess in the death rate among the insured is limited entirely to the first age period, one to four years. The figures suggest the possibility that the city-dwellers develop their cases of measles earlier in childhood. Fewer cases probably occur after age ten among city children than among those living in the country with correspondingly lower mortality rates.

(b) Scarlet Fever

Scarlet fever had the lowest death rate (5.0 per 100,000) of the four principal epidemic diseases of children (measles, scarlet fever, whooping cough, and diphtheria). It caused 5,698 deaths, or a little over four-tenths of one per cent. of the total deaths at all ages, of the policyholders of the five cooperating Industrial companies. Of the 5,698 deaths from this disease, 2,582, or a little over 45 per cent., were those of children from one to four years of age; 1,894 of the decedents, or 33 per cent., were aged five to nine years. The 2,582 deaths at ages one to four constituted about two per cent. of the

deaths from all causes in this age group (126,566), while the 1,894 deaths of children aged five to nine years totaled almost three and one-half per cent. of the 56,125 deaths in this age period.

While scarlet fever has a lower death rate than either measles or whooping cough, it has a much higher case-fatality rate. Like measles, whooping cough and diphtheria, its mortality is highest in the earliest age period, but its death rate is much lower in this age group than either of these other epidemic conditions of childhood. In the age group five to nine years, it has a considerably higher rate than has measles, and its mortality is over three times that for whooping cough. At no age period, however, does it attain as much importance as a mortality factor as does diphtheria. Like measles and diphtheria, this disease is important not only on account of its case incidence and death rate, but on account of the many serious impairments that are initiated by it. The medical world has long recognized the importance of scarlet fever as a cause of cardiac and renal impairment; otitis media and deafness are also frequently traceable to scarlet fever.

Analysis of the death rates for each of the five years of the quinquennium, 1916 to 1920, shows without exception, higher rates among the policyholders of the five companies than in the general population of the Registration Area. This result is expected and for the same reasons as were given for measles. Scarlet fever has a higher rate in the cities than in the rural districts; and, as the Industrial policyholders constitute almost an entirely urban group, they would in the normal course of events, have a higher mortality from this disease than prevails in the general population with its large rural content. Again, the figures for the general population are influenced to some extent by the inclusion of colored children for whom the scarlet fever death rate is very low. The insured children covered by this study are practically all white children. A third factor favoring the general population is the greater concentration of the insured in the age periods where scarlet fever has its highest death rates.

The scarlet fever death rate fluctuates somewhat from year to year, as is likely to be the case with any epidemic disease. But the trend of the death rate during the five years covered by this study is rather discouraging. It will be seen in the following table that in the Registration Area experience, the death rate for the year 1920 was higher than that for any year of the quinquennium, and that for the insured the rate of 6.2 per 100,000 for 1920 was also higher than

that for any other year save 1917 for which an identical rate was recorded. It is obvious that present-day public health measures are not succeeding in their efforts to control this disease. There has been no more unfavorable development in the health situation of recent years than the upward tendency which has been in evidence in the mortality from scarlet fever. There is no clear evidence that, as a countrywide proposition, public health work has succeeded in lessening either case incidence or case fatality.

The following table shows the death rates for scarlet fever for each year of the five-year period, 1916 to 1920, among insured white persons of the five cooperating companies and among the population of the Area:

TABLE 68

Deaths and Death Rates per 100,000 from Scarlet Fever. Intercompany Industrial Mortality Experience and United States Registration Area (Ages 1 to 74 Years), Compared for Period 1916 to 1920

YEAR	DEATH RATES PER 100,000			NUMBER OF DEATHS	
	Interco. Ind'l.	U. S. Reg. Area	Per cent. Interco. of U. S. Reg. Area	Interco. Ind'l.	U. S. Reg. Area
1916-1920	5.0	3.5	142.9	5,698	13,479
1920	6.2	4.6	134.8	1,606	3,787
1919	4.1	2.8	146.4	1,006	2,272
1918	3.9	2.8	139.3	884	2,227
1917	6.2	4.1	151.2	1,331	2,966
1916	4.3	3.2	134.4	871	2,227
Per cent. increase 1916-1920	44 2	43.8	....	....	....

The following table presents the death rates for scarlet fever for the Industrial policyholders of the five cooperating companies and for the general population of the United States Registration Area (ages one to 74 years), compared for each significant age group.

TABLE 69

Death Rates per 100,000 from Scarlet Fever. Intercompany Industrial Mortality Experience and United States Registration Area (Ages 1 to 74 Years), Compared by Age Periods for Quinquennium 1916 to 1920

AGE PERIODS	Interco. Ind'l.	U. S. Reg. Area	Per cent. Interco. Ind'l. of U. S. Reg. Area
All ages—one and over*.....	5.0	3.5	142.9
1 to 4.....	24.6	18.2	135.2
5 to 9.....	12.0	9.9	121.2
10 to 14.....	4.0	3.5	114.3
15 to 19.....	2.1	2.1	100.0
20 to 24.....	1.6	1.5	106.7
25 to 34.....	.9	.9	100.0
35 to 44.....	.3	.4	75.0
45 to 54.....	.2	.2	100.0
55 to 64.....	.1	.1	100.0
65 to 74.....	.1	.1	100.0

* Ages 1 to 74 years for U. S. Reg. Area.

(c) Whooping Cough

Whooping cough was third in numerical importance among the four principal epidemic diseases of childhood. It caused 6,167 deaths during the five year period 1916 to 1920 and its death rate was 5.4 per 100,000. These 6,167 deaths constituted 0.5 per cent. of the mortality from all causes at all ages. This disease, however, is of little importance as a cause of death or of sickness after the age of five years is reached. As a matter of fact it is in the first year of life that the morbidity and the mortality reaches its maximum. On the average in general population mortality statistics about sixty per cent. of all the deaths from this disease are those of babies under one year of age. In this insurance experience no figures are available for infants since children were not insured until they had attained the age of one year. It is thus obvious that the whooping cough mortality statistics of the Industrial policyholders do not cover the most important year of life. Five thousand, four hundred and ninety-five deaths, or 89.1 per cent. of the total mortality from the disease among insured children occurred between the ages of one and four years. In this age group, whooping cough is a very important cause of death as is evidenced by the fact that it caused 4.3 per cent. of the total mortality from all causes among children of these ages.

The death rate for whooping cough varies widely from year to year as is the case with all epidemic diseases. In 1918, the rate 8.9 was more than three times as high as in the following year. The death rate of the United States Registration Area was also very much higher in 1918 than has been recorded in many years. There are no significant differences shown in the whooping cough death rates of the Industrial policyholders and those of the general population of the country. Whooping cough shows uniformly lower rates at every age period among the insured. The general population death rate would, of course, be much higher if the first year of life were included. With this important age group excluded, however, we see by the following table that for the insurance and the general population experiences an identical death rate (5.4 per 100,000) was recorded for the quinquennium. This result, as in the case of that for measles, is decidedly contrary to the expected. Whooping cough is a disease from which the mortality is higher in rural than in urban districts. We would, therefore, expect to encounter considerably higher death rates in the United States Registration Area with its rural content of about fifty per cent. The explanation lies in the larger proportion of children at the younger ages among the insured.

The following table shows the death rates for whooping cough for each year of the five year period among insured white persons of the five cooperating companies and among the population of the Registration Area, ages one to seventy-four years.

TABLE 70

Deaths and Death Rates per 100,000 from Whooping Cough. Intercompany Industrial Mortality Experience and United States Registration Area (Ages 1 to 74 Years), Compared for Period 1916 to 1920

YEAR	DEATH RATES PER 100,000			NUMBER OF DEATHS	
	Interco. Ind'l.	U. S. Reg. Area	Per cent. Interco. of U. S. Reg. Area	Interco. Ind'l.	U. S. Reg. Area
1916-1920	5.4	5.4	100.0	6,167	20,858
1920	5.8	5.8	100.0	1,489	4,772
1919	2.8	2.6	107.7	681	2,099
1918	8.9	9.1	97.8	2,029	7,137
1917	4.5	5.0	90.0	963	3,581
1916	5.0	4.8	104.2	1,005	3,269
Per cent. increase 1916-1920	16.0	20.8	....	....	....

The following table presents the death rates for whooping cough for the Industrial policyholders of the five cooperating companies and for the general population of the United States Registration Area compared for each significant age group:

TABLE 71

Death Rates per 100,000 from Whooping Cough. Intercompany Industrial Mortality Experience and United States Registration Area (Ages 1 to 74 Years), Compared by Age Periods for Quinquennium 1916 to 1920

AGE PERIODS	Interco. Ind'l.	U. S. Reg. Area	Per cent. Interco. Ind'l. of U. S. Reg. Area
All ages—one and over*	5.4	5.4	100.0
1 to 4	52.3	55.4	94.4
5 to 9	3.7	5.0	74.0
10 to 14	.2	.8	25.0

* Ages 1 to 74 years for U. S. Reg. Area.

(d) Diphtheria

Diphtheria, with 26,206 deaths, was the leading cause of death among the four principal epidemic diseases of children among the

Industrial policyholders of the five companies cooperating in this study. In fact, the mortality from this disease was greater than the combined mortality from measles, scarlet fever and whooping cough. Its death rate was 22.9 per 100,000 as compared with 7.9 for measles, 5.4 for whooping cough and 5.0 for scarlet fever. Diphtheria caused approximately two per cent. of the mortality at all ages among the Industrial policyholders. At the age period one to four years, in which over half of the deaths from diphtheria occurred, it caused 13,731 deaths, corresponding to a death rate of 130.8 per 100,000 policyholders of this age group. At ages one to four, diphtheria was fourth in importance among the causes of death, being outranked only by influenza, pneumonia and diarrheal complaints. As a matter of fact, in normal years its death rate is far higher for this age group than that for influenza, and in such years pneumonia and diarrheal diseases were the only causes of death that outranked it in importance. It is also a very important cause of death in the next highest age group, five to nine years, in which it caused 9,363 deaths corresponding to a death rate of 59.3 per 100,000. This is a little over one-sixth of the total mortality at these ages.

In this age-period diphtheria was far and away the leading cause of death among the Industrial policyholders. Its death rate of 59.3 per 100,000 may be compared with 41.0 for influenza, 35.2 for pneumonia and 22.3 for all forms of tubercular diseases combined. Its death toll at this age even exceeded that for all forms of accident combined (58.3 per 100,000). It is also a prominent cause of death in the age group ten to fourteen years, when it caused 1,897 deaths among the Industrial policyholders, with a rate of 13.8 per 100,000.

Analysis of the trend of the diphtheria death rate during the quinquennium 1916 to 1920 discloses a very discouraging situation with reference to this controllable disease. For a disease on which the attention of health officials has been focused during the past decade, to the extent that it has on diphtheria, even a slight upward tendency in the death rate is discouraging; yet, this is what has happened among these Industrial policyholders as well as among the general population. With one exception the rate for the former for 1920 (23.0 per 100,000)was the highest of the quinquennium. It is true that there was no very pronounced upward tendency, but there is sufficient to show that among children of the wage-earning group of our cities health officials are far from their objective of diphtheria control. The diphtheria situation among the children of the cities in recent years, as shown by the figures for these Industrial

policyholders, is one of the conspicuous bad spots in a generally favorable health situation. This is true despite the fact that the means for lowering both its case incidence and lethality are, or should be, known to every health officer and physician. The Schick test should be used to determine whether or not children are susceptible to diphtheria and toxin-antitoxin should be administered to those found to be susceptible. These are recognized preventive measures which would, if employed everywhere, reduce diphtheria to the status of a negligible entity as a cause of death.

The following table shows the death rates for diphtheria for each year of the five year period 1916 to 1920, among insured white persons of the five cooperating companies and among the population of the Registration Area:

TABLE 72

Deaths and Death Rates per 100,000 from Diphtheria. Intercompany Industrial Mortality Experience and United States Registration Area (Ages 1 to 74 Years), Compared for Period 1916 to 1920

YEAR	DEATH RATES PER 100,000			NUMBER OF DEATHS	
	Interco. Ind'l.	U. S. Reg. Area	Per cent. Interco. of U. S. Reg. Area	Interco. Ind'l.	U. S. Reg. Area
1916-1920	22.9	14.3	160.1	26,206	55,143
1920	23.0	14.8	155.4	5,938	12,271
1919	22.8	14.2	160.6	5,587	11,692
1918	21.0	13.1	160.3	4,807	10,302
1917	25.6	15.8	162.0	5,487	11,438
1916	21.8	13.7	159.1	4,387	9,440
Per cent. increase 1916-1920	5.5	8.0	....	....	....

Comparison of the death rates in the above table shows much lower mortality each year in the general population than among the insured. As with measles and scarlet fever this is expected in view of the concentration of the Industrial policyholders in the cities where the diphtheria death rate is much higher than in the rural districts in which are included almost half of the population of the Registration Area. The fact that this insurance study relates, almost entirely, to white policyholders also leads us to expect a diphtheria

death rate in excess of that for the general population, since diphtheria mortality of white children is much higher than that of the colored.

The following table presents the death rates for diphtheria for the Industrial policyholders of the five cooperating companies and for the general population of the United States Registration Area (ages one to 74 years), compared for each significant age group.

TABLE 73

Death Rates per 100,000 from Diphtheria. Intercompany Industrial Mortality Experience and United States Registration Area (Ages 1 to 74 Years), Compared by Age Periods for Quinquennium 1916 to 1920

AGE PERIODS	Interco. Ind'l.	U. S. Reg. Area	Per cent. Interco. Ind'l. of U. S. Reg. Area
All ages—one and over*	22.9	14.3	160.1
1 to 4	130.8	92.0	142.2
5 to 9	59.3	43.3	137.0
10 to 14	13.8	10.9	126.6
15 to 19	3.7	3.2	115.6
20 to 24	1.9	1.7	111.8
25 to 34	1.5	1.3	115.4
35 to 44	1.0	1.0	100.0
45 to 54	.8	1.0	80.0
55 to 64	.7	.8	87.5
65 to 74	.6	.8	75.0

* Ages 1 to 74 years for U. S. Reg. Area.

XIV. DIARRHEA AND ENTERITIS †

Since the industrial insurance companies did not insure infants under one year of age, these insurance figures do not cover the age group among which the great bulk of the mortality from diarrheal complaints is experienced. There do occur, however, very many deaths among children between the ages of one and two years. These deaths of children in the second year of life are usually classified as deaths from "infantile diarrhea" and are grouped together with the mortality among young infants. In this present study, however,

† Under the heading "diarrhea and enteritis" are classified all forms of inflammatory, ulcerative or catarrhal disease of the intestines or of the gastroenteric tract (where the intestines were chiefly involved), except such diarrheal diseases as were definitely described in the death reports as secondary to other diseases, and except those, also, which were due to tuberculous, dysenteric or malarial inflammation of the intestines.

inasmuch as lack of data for infants under one year of age prevents the giving of worthwhile information about "infantile diarrhea," it has been decided to make no attempt to do so. All deaths from diarrheal disease from age one to the highest age group will be presented by age periods and will be discussed in accordance with the general scheme followed for the other important diseases covered by this report.

Diarrheal disease in its several forms was an important cause of death in this Industrial insurance experience. No less than 24,268 deaths were reported from these intestinal and gastrointestinal inflamations. This is 1.8 per cent. of the total mortality at all ages. Seventeen thousand two hundred and ninety deaths, or 71 per cent. of the total mortality from diarrheal diseases in this experience occurred among children between the ages of one and four years. These deaths constituted 1.4 per cent. of the mortality from all causes in this age group. Diarrheal diseases are not important as a cause of death in late childhood, nor are they of much importance among adults until old age is reached. At ages 75 and over they caused over one per cent. of the mortality from all causes among the Industrial policyholders.

The following table shows the number of deaths and the death rates per 100,000 Industrial policyholders of the five cooperating companies for all ages combined and for each significant age group during the five year period 1916 to 1920:

TABLE 74

Deaths and Death Rates per 100,000 from Diarrhea and Enteritis. Intercompany Industrial Mortality Experience, 1916 to 1920 By Age Periods

AGE PERIODS	Number of Deaths	Death Rates per 100,000
All ages—one and over	24,268	21.2
1 to 4	17,290	164.6
5 to 9	1,108	7.0
10 to 14	232	1.7
15 to 19	136	1.1
20 to 24	219	1.9
25 to 34	590	3.1
35 to 44	634	4.8
45 to 54	739	7.6
55 to 64	1,058	16.6
65 to 74	1,346	52.5
75 and over	916	167.9

The following table presents for the Industrial policyholders of the five cooperating companies and for the population of the United States Registration Area, aged one to 74 years, the death rates for diarrhea and enteritis for each year of the quinquennium 1916 to 1920:

TABLE 75

Deaths and Death Rates per 100,000 from Diarrhea and Enteritis. Intercompany Industrial Mortality Experience and United States Registration Area (Ages 1 to 74 Years), Compared for Period 1916 to 1920

YEAR	DEATH RATES PER 100,000			NUMBER OF DEATHS	
	Interco. Ind'l.	U. S. Reg. Area	Per cent. Interco. of U. S. Reg. Area	Interco. Ind'l.	U. S. Reg. Area
1916-1920	21.2	23.1	91.8	24,268	88,863
1920	16.0	17.4	92.0	4,120	14,444
1919	16.3	18.8	86.7	3,986	15,431
1918	23.0	26.0	88.5	5,265	20,366
1917	25.6	28.4	90.1	5,488	20,493
1916	26.9	26.4	101.9	5,409	18,129
Per cent. decrease 1916-1920	40.5	34.1	....	....	....

The above table indicates that both among the wage-earning group and the general population of the United States Registration Area, aged one to 74 years, there has been a very considerable drop in the mortality from diarrheal disease in recent years. A number of facts have doubtless been operative in bringing about the lower death rate observed in the last two years of the quinquennium. More is being learned every year about infant feeding. With each year the pasteurization of milk and the regulation and improvement of conditions under which it is sold, are subjects which are claiming the attention of health authorities. The water supplies, not only of the large cities, but of the smaller municipalities, are being improved; and even in the rural districts more attention is being paid to the location of wells and to the prevention of contamination of springs or other sources of water supply. Diarrheal diseases are "preventable" and there is every reason to expect that the modern public health movement will ultimately succeed in practically stamping them out.

XV. THE PUERPERAL STATE

Puerperal diseases, including all conditions dependent upon pregnancy and parturition, together with affections of the breast during lactation, caused 22,980 deaths among women insured in the Industrial Departments of the five cooperating companies. This is equivalent to a death rate of 20.0 per 100,000 policyholders or 1.7 per cent. of the total mortality at all ages. At the age group 15 to 44 years, deaths from puerperal diseases accounted for 4.6 per cent. of the total mortality. These facts indicate the relative numerical importance of puerperal diseases among all the causes of death in the total mortality experience, regardless of sex. As no figures are available in this study to show the sex distribution of Industrial policyholders, we are unable to determine the relative importance of these puerperal affections as causes of death among insured *women;* nor are we able even to show their status among *females* of the childbearing ages. The facts at hand enable us, however, to give data concerning the age distribution of the deaths from puerperal conditions, as well as the trend of the crude death rate among the insured, as compared with that for the general population. The data show, also, the relative importance of the mortality from the important types of puerperal disease and the age distribution of the deaths from each type. It is also possible to measure the effect of the influenza pandemic as a factor in increasing the puerperal death rate in certain years.

The following table shows the number of deaths from puerperal diseases and the death rates per 100,000 Industrial policyholders of the five cooperating companies for all ages combined and for each significant age group during the five-year period 1916 to 1920, together with the death rates at specified age divisions for each calendar year, 1916 to 1920.

TABLE 76

Deaths and Death Rates per 100,000 from Puerperal State (Total). Intercompany Industrial Mortality Experience, 1916 to 1920 By Age Periods

Age Periods	1916 to 1920		Death Rates per 100,000				
	Number of Deaths	Death Rate per 100,000	1920	1919	1918	1917	1916
All ages—One and over	22,989	20.0	21.8	18.8	24.6	17.5	16.8
1 to 4	.....	.....	.....	.....	.....	.....	.....
5 to 9	.....	.....	.....	.....	.....	.....	.....
10 to 14	18	.1	.1	.2	.....	.3	.1
15 to 19	1,865	15.5	16.6	14.3	19.9	14.6	11.7
20 to 24	5,620	49.0	53.2	44.4	63.5	43.4	39.0
25 to 34	10,651	56.7	62.3	54.0	72.8	46.1	45.6
35 to 44	4,670	35.6	38.8	34.9	36.1	33.5	33.8
45 to 54	152	1.6	2.0	1.5	1.6	1.2	1.5
55 to 64	4	.1	.....	.1	.1	.1	.1
65 to 74	.....	.....	.....	.....	.....	.....	.....
75 and over	.....	.....	.....	.....	.....	.....	.....

The great bulk of the deaths from diseases connected with pregnancy and child-birth, is, of course, restricted to the "child-bearing" age groups, that is, to those between 15 and 45 years. There were only 174 deaths in all of the other age groups combined; of these, 18 were deaths of girls aged 10 to 14 years, 152 of women between the ages of 45 and 54, and 4 deaths which were reported among women aged 55 to 64. Deaths in the last group, while extremely infrequent, are, nevertheless, reported now and then, and in some instances the ages are actually authenticated. Records of deaths of women aged 55 to 64 years are also found in the Census Bureau mortality reports.

The effect of the influenza epidemic upon the death rates from puerperal conditions is apparent from the facts shown in the foregoing table. In 1918, at the age range 15 to 19 years, the rate increased 36 per cent. over the figure for 1917; at 20 to 24 years, 46 per cent., at 25 to 34 years, where influenza was most destructive, 58 per cent., and at the age group 35 to 44 years, 8 per cent. Excess mortality continued to prevail in these age ranges throughout 1919 and 1920.

The following table presents the death rates for puerperal diseases for the Industrial policyholders of the five cooperating companies and for the general population of the United States Registration Area (ages one to 74 years), compared for each significant age group.

TABLE 77

Death Rates per 100,000 from Puerperal State (Total). Intercompany Industrial Mortality Experience and United States Registration Area (Ages 1 to 74 Years), Compared by Age Periods for Quinquennium 1916 to 1920

AGE PERIODS	Interco. Ind'l.	U. S. Reg. Area	Per cent. Interco. Ind'l. of U. S. Reg. Area
All ages—one and over*	20.0	19.0	105.3
1 to 4	....	....	....
5 to 9	....	....	....
10 to 14	.1	.5	20.0
15 to 19	15.5	17.8	87.1
20 to 24	49.0	41.2	118.9
25 to 34	56.7	47.8	118.6
35 to 44	35.6	30.5	116.7
45 to 54	1.6	2.0	80.0
55 to 64	.1	....	....
65 to 74	....	....	....

* Ages 1 to 74 years for U. S. Reg. Area.

The death rate for puerperal diseases was higher for insured women than for those of the general population, not only at all ages, but for each important age group save 15 to 19 years. If it were possible to locate the cause of the relatively higher general population mortality in this last period, we should probably find it accounted for, largely, by the high death rate among young colored women. A very high birth rate obtains among adolescent negro females, and in a considerable number of their confinements proper medical care is not accorded. In each of the age-ranges 20 to 24, 25 to 34, and 35 to 44 years, a considerable excess was recorded for the insured: this amounted to 19 per cent. at both 20 to 24, and 25 to 34 years, and to 17 per cent. at 35 to 44 years.

The following table presents, for the Industrial policyholders of the five cooperating companies, and for the population of the Registration Area, aged 1 to 74 years, the number of deaths from, and the death rates for puerperal diseases, for each year of the quinquennium, 1916 to 1920:

TABLE 78

Deaths and Death Rates per 100,000 from Puerperal State (Total). Intercompany Industrial Mortality Experience and United States Registration Area (Ages 1 to 74 Years), Compared for Period 1916 to 1920

Year	Death Rates per 100,000			Number of Deaths	
	Interco. Ind'l.	U. S. Reg. Area	Per cent. Interco. Ind'l. of U. S. Reg. Area	Interco. Ind'l.	U. S. Reg. Area
1916-1920	20.0	19.0	105.3	22,980	73,027
1920	21.8	19.6	111.2	5,631	16,293
1919	18.8	17.6	106.8	4,610	14,449
1918	24.6	23.1	106.5	5,627	18,142
1917	17.5	17.3	101.2	3,747	12,514
1916	16.8	16.9	99.4	3,365	11,629
Per cent. increase 1916-1920	29.8	16.0	....	....	....

The trend of the puerperal death rate from 1916 to 1920 was upward, both among the women of the wage-earners' families and those of the general population. This was due largely to the influenza pandemic of 1918-1919, as well as to the recrudescence of that disease in the early months of 1920. Influenza affected pregnant women by causing abortions and miscarriages. This will be discussed more fully in the comments on "accidents of pregnancy," pages 118 to 123. Influenza interfered, also, with the normal progress of labor, as will be shown in the section on "accidents of labor."

The figures in the above table show that the maximum death rate for puerperal diseases was recorded in 1918, the year of maximum influenza prevalence and mortality; that the next highest was that for 1920. In 1919, in which the influenza mortality was also much higher than in normal years, the deaths from puerperal conditions also exceeded the mortality of "normal" years.

With the exception of 1916, each year of the five year period showed a higher puerperal death rate among women of wage-earners' families than among those of the general population. The differences, however, were small, and are accounted for largely by the greater concentration of the former in the cities where the puerperal death rate exceeds that of the rural districts. The margins between the two experiences would have been greater were it not for the fact

that in the general population a considerable proportion of colored people, with their high puerperal mortality, is included, whereas the death rates for the Industrial policyholders relate entirely to white lives.

Types of Puerperal Disease

Of the 22,980 deaths from all forms of puerperal disease, 7,549 or 33 per cent., were due to septicemia, 24 per cent. to albuminuria and convulsions, 16 per cent. to the "accidents of pregnancy," which are principally abortions and miscarriages, and 15 per cent. to "accidents of labor," excluding hemorrhage. The remaining 13 per cent. were reported as due either to phlegmasia alba dolens, embolism, or to diseases of the breast during lactation. Many were vaguely described as due to "child-birth," "parturition," "confinement," "labor," etc., with no indication of the exact nature of the disease. The great majority of these indefinitely described cases would have been classified under the more definite headings like puerperal septicemia or puerperal albuminuria if more specific reports had been made by physicians. A comparison of the deaths and death rates from the several important puerperal diseases and conditions is given in the following table:

TABLE 79

Deaths and Death Rates per 100,000 from Principal Diseases and Conditions of the Puerperal State. Intercompany Industrial Mortality Experience, 1916 to 1920

Disease or Condition	1916 to 1920		Death Rates per 100,000					
	Deaths	Per cent. of total Puerp. Diseases	1916 to 1920	1920	1919	1918	1917	1916
Puerperal state—Total	22,980	100.0	20.0	21.8	18.8	24.6	17.5	16.8
Accidents of pregnancy	3,564	15.5	3.1	2.9	3.0	6.3	1.5	1.5
"Other accidents of labor"	3,476	15.1	3.0	3.3	3.1	5.2	1.6	1.6
Puerperal septicemia	7,549	32.9	6.6	7.5	5.7	6.1	7.0	6.7
Puerperal albuminuria and convulsions	5,431	23.6	4.7	5.0	4.5	4.7	4.9	4.6
Other puerperal dis.& conditions	2,960	12.9	2.6	3.1	2.5	2.3	2.5	2.4

From this table, also, the effect of the influenza epidemic is evident. The death rates for "accidents of pregnancy" and for "other accidents of labor" (excluding hemorrhage) were increased

320 and 225 per cent. respectively in 1918, and excess rates (approximately 100 per cent.) prevailed in 1919 and 1920.

(a) Puerperal Septicemia*

Puerperal septicemia was the leading cause of death among the diseases incidental to the maternal state. It caused 33 per cent. of the mortality from all puerperal causes, and its crude death rate was 6.6 per 100,000.

The highest mortality rate for puerperal septicemia was that for the age period 25 to 34 years (18.4 per 100,000); but this exceeds only slightly the figure for the age group 20 to 24 years (17.2). Septicemia was the leading puerperal disease, not only at all ages, but for each age period with the exception of 15 to 19 years; here the rate for puerperal albuminuria and convulsions exceeded it slightly.

The following table shows the number of deaths from puerperal septicemia and the death rates per 100,000 Industrial policyholders of the five cooperating companies for all ages combined and for each significant age group during the five year period 1916 to 1920.

* Under this heading were classified all deaths incidental to child-bearing in connection with which any septic process, or almost any inflammatory process, was reported. It includes conditions dependent upon pregnancy, as well as parturition. For example, a death reported from abortion with septicemia would be classified here rather than as an "accident of pregnancy." A death following an instrumental delivery, followed by septicemia, would be classified here rather than under the title "accidents of labor." In the majority of cases, however, the deaths under this heading were reported as due either to puerperal septicemia or puerperal peritonitis, complicating or following labor.

TABLE 80

Deaths and Death Rates per 100,000 from Puerperal Septicemia. Intercompany Industrial Mortality Experience, 1916 to 1920 By Age Periods

AGE PERIODS	Number of Deaths	Death Rates per 100,000
All ages—one and over	7,549	6.6
1 to 4	....	...
5 to 9	....	...
10 to 14	10	.1
15 to 19	647	5.4
20 to 24	1,969	17.2
25 to 34	3,451	18.4
35 to 44	1,426	10.9
45 to 54	45	.5
55 to 64	1	...
65 to 74	....	...
75 and over	....	...

The following table presents the death rates for puerperal septicemia for the Industrial policyholders of the five cooperating companies and for the general population of the United States Registration Area (ages one to 74 years), compared for each significant age group.

TABLE 81

Death Rates per 100,000 from Puerperal Septicemia. Intercompany Industrial Mortality Experience and United States Registration Area (Ages 1 to 74 Years), Compared by Age Periods for Quinquennium 1916 to 1920

AGE PERIODS	Interco. Ind'l.	U. S. Reg. Area	Per cent. Interco. Ind'l. of U. S. Reg. Area
All ages—one and over*	6.6	6.7	98.5
1 to 4	....	....	....
5 to 9	....	....	....
10 to 14	.1	.2	50.0
15 to 19	5.4	6.6	81.8
20 to 24	17.2	15.8	108.9
25 to 34	18.4	17.0	108.2
35 to 44	10.9	9.6	113.5
45 to 54	.5	.6	83.3
55 to 64	....	....	....
65 to 74	....	....	....

* Ages 1 to 74 years for U. S. Registration Area.

The general population death rate at all ages for puerperal septicemia (6.7 per 100,000) was substantially the same as that for the insured (6.6); but slight excesses were recorded for the latter in the age-groups 20 to 24, 25 to 34, and 35 to 44 years. Ninety-one per cent. of the mortality from this disease occurred during this age-range. The maximum excess was that for the period 35 to 44 years (13.5 per cent).

There was no definite upward or downward trend in the puerperal septicemia death rate during the quinquennium 1916 to 1920, either among the insured or in the general population, although in the case of the former a much higher rate prevailed in the latest year, 1920, than was recorded for 1916. In this respect, the experience for septicemia differs very materially from that for all puerperal conditions combined, for "accidents of pregnancy," and for "other accidents of labor."

The general population death rates in four of the five years were slightly higher than those for the insured. This is accounted for largely by the fact that the general population figures are based upon an exposure in which colored, as well as white women, are represented, whereas the insurance exposure is an almost entirely white one. As the puerperal septicemia death rate of colored women is far in excess of that for the whites, the inclusion of the former is undoubtedly an important factor in bringing about the slightly higher mortality of the general population. Evidently, it more than compensated for certain other factors which would lead us to expect the death rate of women of insured wage-earners' families to be the higher. These factors are, first, the residence of the wage-earners in urban communities where, as shown by the experience of many years, the death rates for puerperal septicemia are much higher than in the rural districts; second, the less favorable economic status of wage-workers as a group, their inability to obtain as high a type of medical attendance, their extensive use of midwife service, and their more general lack of knowledge of personal hygiene.

The following table presents, for the Industrial policyholders of the five cooperating companies, and for the population of the Registration Area, aged 1 to 74 years, the number of deaths from, and the death rates for puerperal septicemia, for each year of the quinquennium, 1916 to 1920.

TABLE 82

Deaths and Death Rates per 100,000 from Puerperal Septicemia Intercompany Industrial Mortality Experience and United States Registration Area (Ages 1 to 74 Years), Compared for Period 1916 to 1920

YEAR	DEATH RATES PER 100,000			NUMBER OF DEATHS	
	Interco. Ind'l.	U. S. Reg. Area	Per cent. Interco. In'l. of U.S. Reg. Area	Interco. Ind'l.	U. S. Reg. Area
1916 to 1920.....	6.6	6.7	98.5	7,549	25,776
1920	7.5	6.8	110.3	1,926	5,609
1919	5.7	6.0	95.0	1,387	4.939
1918	6.1	6.7	91.0	1,393	5,239
1917	7.0	7.2	97.2	1,497	5,207
1916	6.7	7.0	95.7	1,346	4,782
Per cent. increase, 1916-1920	11.9	2.9*	....	....	....

* Decrease.

(b) Puerperal Albuminuria and Convulsions †

The death rate among the insured for puerperal albuminuria and convulsions was 4.7 per 100,000 during the five-year period, 1916 to 1920. Among the puerperal diseases, it ranks next to septicemia in numerical importance. This is true for all ages combined and for each age period, with the exception of 15 to 19 years. Here it is the leading cause of death. Its frequency among primiparae has much to do with this.

The following table shows the number of deaths from puerperal albuminuria and convulsions and the death rates per 100,000 Industrial policyholders of the five cooperating companies for all ages combined, and for each significant age group during the five-year period, 1916 to 1920.

† Under this heading are classified the fatal cases of puerperal toxemia, as distinguished from those of septic infection. The most frequent reports tabulated here are puerperal albuminuria, convulsions, eclampsia, nephritis, uremia and toxemia. In the great majority of such cases there is a distinct involvement of kidney insufficiency. This group of conditions occurs most frequently in primiparae, and for the most part during labor, but they are a common cause of death also during pregnancy, and occur now and then during the puerperium.

TABLE 83

Deaths and Death Rates per 100,000 from Puerperal Albuminuria and Convulsions.
Intercompany Industrial Mortality Experience, 1916 to 1920
By Age Periods

AGE PERIODS	Number of Deaths	Death Rates per 100,000
All ages—one and over	5.431	4.7
1 to 4	....	...
5 to 9	....	...
10 to 14	5	...
15 to 19	673	5.6
20 to 24	1,455	12.7
25 to 34	2,184	11.6
35 to 44	1,084	8.3
45 to 54	29	.3
55 to 64	1	...
65 to 74	....	...
75 and over	....	...

The following table presents the death rates for puerperal albuminuria and convulsions for the Industrial policyholders of the five cooperating companies and for the general population of the United States Registration Area (ages one to 74 years), compared for each significant age group, period 1916 to 1920.

TABLE 84

Death Rates per 100,000 from Puerperal Albuminuria and Convulsions.
Intercompany Industrial Mortality Experience and United States Registration Area (Ages 1 to 74 Years), Compared by Age Periods for Quinquennium 1916 to 1920

AGE PERIODS	Interco. Ind'l.	U. S. Reg. Area	Per cent. Interco. Ind'l. of U. S. Reg. Area
All ages—one and over*	4.7	4.6	102.2
1 to 4	....	....	....
5 to 9	....	....	....
10 to 14	....	.2	....
15 to 19	5.6	6.8	82.4
20 to 24	12.7	10.9	116.5
25 to 34	11.6	10.1	114.9
35 to 44	8.3	7.0	118.6
45 to 54	.3	.5	60.0
55 to 64	....	....	....
65 to 74	....	....	....

* Ages 1 to 74 years for U. S. Reg. Area.

As in the case of puerperal septicemia the crude total death rates for puerperal albuminuria and convulsions are almost identical in the Intercompany and general population experiences, although the rates for the four significant age groups show higher mortality among insured women in every instance except the age-period 15 to 19 years.

As in the case of septicemia, no pronounced upward or downward trend of the death rate was observed during the period, 1916 to 1920. This applies both to the women insured in the Industrial Departments of the five cooperating companies, and to those of the general population. The rates for the two experiences are substantially the same for each year of the five-year period.

The following table presents for the Industrial policyholders of the five cooperating companies and for the population of the Registration Area, aged 1 to 74 years, the number of deaths from, and the death rate for puerperal albuminuria and convulsions, for each year of the quinquennium 1916 to 1920:

TABLE 85

Deaths and Death Rates per 100,000 from Puerperal Albuminuria and Convulsions.
Intercompany Industrial Mortality Experience and United States Registration Area (Ages 1 to 74 Years), Compared for Period 1916 to 1920

YEAR	DEATH RATES PER 100,000			NUMBER OF DEATHS	
	Interco. Ind'l.	U. S. Reg. Area	Per cent. Interco. Ind'l. of U. S. Reg. Area	Interco. Ind'l.	U. S. Reg. Area
1916 to 1920.....	4.7	4.6	102.2	5,431	17,816
1920	5.0	4.9	102.0	1,282	4,103
1919	4.5	4.4	102.3	1,109	3,581
1918	4.7	4.6	102.2	1,080	3,646
1917	4.9	4 7	104.3	1,044	3,403
1916	4.6	4.5	102.2	916	3,083
Per cent increase 1916-1920	8.7	8.9	....	....	....

(c) Accidents of Pregnancy

The deaths classified under this heading are those of women who died before term, usually of the effects of abortions or miscar-

riages. Also included here are deaths resulting from ectopic gestation, uncontrollable vomiting of pregnancy, and a few other conditions. These "accidents of pregnancy" considered as a group, were the third cause of death in numerical importance among puerperal diseases. They were responsible for 3,564 deaths with a death rate of 3.1 per 100,000. Like puerperal septicemia, their maximum death rate was that for the age period of 25 to 34 years, followed by that for 20 to 24 years. It should be understood that while this total of 3,564 deaths is a fairly close approximation of the total mortality among the insured women from conditions incidental to pregnancy, there were *some* deaths among them which were classified under other titles. The rules of cause of death classification require that in cases where there is a complication of septicemia and abortion the death be classified as one from puerperal septicemia, and that if either puerperal uremia or eclampsia is involved the death be tabulated as one from this cause rather than as one due to abortion. Consequently, in this study, as well as in the United States Government mortality reports, there are no figures which give with absolute accuracy the total mortality from causes incidental to pregnancy.

The following table shows the number of deaths from accidents of pregnancy and the death rates per 100,000 Industrial policyholders of the five cooperating companies, for all ages combined and for each signifiant age group during the five-year period 1916-1920:

TABLE 86

Deaths and Death Rates per 100,000 from Accidents of Pregnancy. Intercompany Industrial Mortality Experience, 1916 to 1920. By Age Periods

AGE PERIODS	Number of Deaths	Death Rates per 100,000
All ages—one and over	3,564	3.1
1 to 4	....	...
5 to 9	....	...
10 to 14	2	...
15 to 19	225	1.9
20 to 24	856	7.5
25 to 34	1,854	9.9
35 to 44	606	4.6
45 to 54	21	.2
55 to 64	....	...
65 to 74	....	...
75 and over	....	...

Analysis by age groups of the deaths from these accidents of pregnancy shows that their distribution resembles closely that for puerperal septicemia, but differs in one important respect from albuminuria and convulsions. The maximum death rate for the latter is that for the period 20 to 24 years, while the highest mortality from accidents of pregnancy occurs between 25 and 34 years. Here it is one-third higher than for the 20 to 24 age group.

The following table presents the death rates for accidents of pregnancy for the Industrial policyholders of the five cooperating companies and for the general population of the United States Registration Area (ages one to seventy-four years), compared for each significant age group, period 1916 to 1920.

TABLE 87

Death Rates per 100,000 from Accidents of Pregnancy. Intercompany Industrial Mortality Experience and United States Registration Area (Ages 1 to 74 Years), Compared by Age Periods for Quinquennium 1916 to 1920

AGE PERIODS	Interco. Ind'l.	U. S. Reg. Area	Per cent. Interco. Ind'l. of U. S. Reg. Area
All ages—one and over*.....	3.1	2.8	110.7
1 to 4.....	....	....	....
5 to 9.....	....	....	....
10 to 14.....	....	....	....
15 to 19.....	1.9	1.7	111.8
20 to 24.....	7.5	5.8	129.3
25 to 34.....	9.9	8.0	123.8
35 to 44.....	4.6	4.0	115.0
45 to 54.....	.2	.2	100.0
55 to 64.....	....	....	....
65 to 74.....	....	....	....

* Ages 1 to 74 years for U. S. Reg. Area.

In every important age group the death rate is higher for insured women than for those of the general population, the greatest excess (29 per cent.) being registered for the period 20 to 24 years.

The death rates for the accidents of pregnancy were highest in the years in which epidemic influenza prevailed. Both in the experience of the insured and that of the general population the mortality quadrupled in 1918, the peak influenza year, as compared with 1917 and 1916. In 1919, during the early months of which influenza

caused many thousands of deaths, and in 1920 when there was a marked recrudescence of this disease, the death rates for accidents of pregnancy both among the insured and general population were about double those of the "normal" years 1916 and 1917.

The fact that pregnant women, more frequently than non-pregnant women, develop pneumonia when attacked by influenza has been definitely established; and this is the chief reason for the high mortality among the former during influenza pandemics. Again, the age periods wherein most pregnancies occur are those ranges in which epidemic influenza had its highest incidence. Thus, whether or not pregnancy acts as a predisposing factor in the *contraction* of influenza, there is great liability that pregnant women when attacked by the disease, will abort. Comparison year by year of the death rate for accidents of pregnancy with that for the other principal forms of puerperal disease brings out clearly the fact that it was the high mortality among pregnant women, and among parturient women, that was responsible for the rise in the puerperal disease death rate observed in the years when influenza reached high prevalence. Thus, there was no increase either in puerperal septicemia or in puerperal eclampsia in 1918; in fact, the death rate for the former was lower than it was in 1916 or 1917. But, as noted above, the accidents of pregnancy death rate more than quadrupled in 1918, and in the other influenza years it was about twice that of "normal" or non-epidemic years.

The following table presents for the Industrial policyholders of the five cooperating companies and for the population of the Registration Area aged 1 to 74 years the number of deaths from and the death rates for accidents of pregnancy for each year of the quinquennium 1916 to 1920.

TABLE 88

Deaths and Death Rates per 100,000 from Accidents of Pregnancy. Intercompany Industrial Mortality Experience and United States Registration Area (Ages 1 to 74 Years), Compared for Period 1916 to 1920

Year	Death Rates per 100,000			Number of Deaths	
	Interco. Ind'l.	U. S. Reg. Area	Per cent. Interco. Ind'l. of U. S. Reg. Area	Interco. Ind'l.	U. S. Reg. Area
1916 to 1920.....	3.1	2.8	110.7	3,564	10,633
1920	2.9	2.8	103.6	759	2,288
1919	3.0	2.5	120.0	746	2,093
1918	6.3	5.4	116.7	1,440	4,240
1917	1.5	1.4	107.1	314	1,028
1916	1.5	1.4	107.1	305	984
Per cent increase 1916-1920	93.3	100.0	....	....	....

It is not possible to give any worthwhile discussion of the trend or tendency of the death rate from these causes during the period to which this report relates. As noted above, the whole picture is colored by the influenza which, in all probability, was the sole cause of the increase observed during the last three years of the quinquennium. While no figures relating to the Industrial policyholders of the five companies are available for the year 1921, it is known that in that year, during which there was no abnormal amount of influenza, the death rate from accidents of pregnancy dropped very materially.

The above table shows for each year slightly higher death rates for insured women than for those of the general population. This condition results partly from the fact that those insured in the Industrial Department of the cooperating companies reside, almost altogether, in the cities where the death rate from certain forms of puerperal disease is higher than in the rural districts. These insured women, as a group, are less favorably situated economically than those in the general population, and it is presumed that they did not have the benefit of as high a grade of medical or obstetrical care. These items leading us to look for higher mortality among the insured women, are partly counterbalanced, however, by the fact

that the figures for the general population relate to *both* white and colored women. There is a considerable colored exposure in the latter, and their death rate is much higher than that for white women. If it were possible at this time to compare the white general population experience with the white insurance experience there is no question but what the divergence between the two would be much greater than that shown in the above table.

(d) Accidents of Labor *

Fourth in numerical importance among the diseases incidental to the maternal state were those grouped under the title heading "other accidents of labor."

Three thousand four hundred and seventy-six deaths, or 15.1 per cent. of the total mortality due to all puerperal causes, were ascribed to these "other accidents of labor." This may be compared with 3,564 deaths from the "accidents of pregnancy." The death rate was 3.0 per 100,000.

Considered by age periods, the highest death rate for "accidents of labor" was that for the age range 25 to 34 years (9.4 per 100,000); next highest was that for the period 20 to 24 years (7.1). The age distribution of the mortality from the conditions listed under this heading resembles closely that for puerperal septicemia and for the "accidents of pregnancy."

The following table shows the number of deaths from "other accidents of labor" and the death rate per 100,000 Industrial policyholders of the five cooperating companies for all ages combined and for each significant age group during the five-year period 1916 to 1920.

* The deaths classified under this heading, in contradistinction to those classified under "accidents of pregnancy," were those of women whose pregnancies had reached "term." Under "accidents of labor," are tabulated reports of injuries to the mother, as in breech or other malpresentations, and in instrumental deliveries. Here also are classified a large number of indefinite reports such as "childbirth," "labor," "confinement," and "parturition," all of which, had more definite designations been forthcoming, would have been assigned to more definite title headings, such as puerperal septicemia, puerperal albuminuria, etc.

TABLE 89

Deaths and Death Rates per 100,000 from Accidents of Labor. Intercompany Industrial Mortality Experience, 1916 to 1920 By Age Periods

AGE PERIODS	Number of Deaths	Death Rates per 100,000
All ages—one and over	3,476	3.0
1 to 4	....	...
5 to 9	....	...
10 to 14	....	...
15 to 19	206	1.7
20 to 24	818	7.1
25 to 34	1,767	9.4
35 to 44	658	5.0
45 to 54	26	.3
55 to 64	1	...
65 to 74	....	...
75 and over	....	...

The following table presents the death rates for "other accidents of labor" for the Industrial policyholders of the five cooperating companies and for the general population of the United States Registration Area (ages 1 to 74 years) compared for each significant age group.

TABLE 90

Death Rates per 100,000 from Accidents of Labor. Intercompany Industrial Mortality Experience and United States Registration Area (Ages 1 to 74 Years), Compared by Age Periods for Quinquennium 1916 to 1920

AGE PERIODS	Interco. Ind'l.	U. S. Reg. Area	Per cent. Interco. Ind'l. of U. S. Reg. Area
All ages—one and over*	3.0	2.6	115.4
1 to 4	....	....	....
5 to 9	....	....	....
10 to 14	....	....	....
15 to 19	1.7	1.9	89.5
20 to 24	7.1	5.4	131.5
25 to 34	9.4	6.8	138.2
35 to 44	5.0	4.3	116.3
45 to 54	.3	.3	100.0
55 to 64	....	....	....
65 to 74	....	....	....

* Ages 1 to 74 years for U. S. Reg. Area.

The death rate for insured women was higher than obtained in the general population at every important age period, with the exception of 15 to 19 years. This coincides with the figures for "accidents of pregnancy," with the exception of this one age period.

As was the case with "accidents of pregnancy," the maximum mortality from these causes occurred in 1918, the year in which epidemic influenza reached its highest prevalence. Like "accidents of pregnancy," also, the death rates for 1919 and 1920, in which influenza mortality was also high, were far in excess of those registered for the normal years of 1916 and 1917. In our comment on "accidents of pregnancy," we referred to the high mortality of pregnant women during influenza pandemics due to abortions and miscarriages. The high death rate of women from the "accidents of labor," seems, also, on the face of the figures, to indicate that influenza is a distinct factor in raising the death rate among women whose pregnancies reach "term." It is probably true that the effects of influenzal infection during pregnancy, even though they may not cause death at the time, so lower the resistance of many pregnant women that they are less able to withstand the perils of labor and of the immediate postpartum period. Before drawing any conclusions from the above figures, we should also give due weight to the fact that many deaths from "childbirth," "labor," etc., are classified under this heading of "accidents of labor." It is very probable that many deaths of pregnant women occurring *before* "term," were actually counted here and that, in consequence, the rates really relate to a composite of both classes.

The following table presents for the Industrial policyholders of the five cooperating companies and for the population of the United States Registration Area, aged 1 to 74, the number of deaths and the death rates for "other accidents of labor" for each year of the quinquennium, 1916 to 1920.

TABLE 91

Deaths and Death Rates per 100,000 from Accidents of Labor. Intercompany Industrial Mortality Experience and United States Registration Area (Ages 1 to 74 Years), Compared for Period 1916 to 1920

YEAR	DEATH RATES PER 100,000			NUMBER OF DEATHS	
	Interco. Ind'l.	U. S. Reg. Area	Per cent. Interco. of U. S. Reg. Area	Interco. Ind'l.	U. S. Reg Area
1916 to 1920.....	3.0	2.6	115.4	3,476	9,998
1920	3.3	2 7	122 2	849	2,255
1919	3.1	2.5	124.0	759	2,078
1918	5.2	4.2	123.8	1,197	3,264
1917	1.6	1.6	100.0	341	1,192
1916	1.6	1.8	88 9	330	1,209
Per cent. increase 1916-1920	106.3	50.0	....	....	....

The above table shows for both the insurance and general population experiences relatively high death rates in the three influenza years, with the maximum in 1918. It will be noted that while the mortality was approximately one-quarter higher among insured women in 1918, 1919 and 1920, an entirely different picture is presented for 1917 and 1916. In 1917, the death rates for the two expereinces were identical (1.6 per 100,000), while in 1916, the figures show lower mortality for the women of wage-earners' families.

XVI. DISEASES OF THE ARTERIES

Arterial diseases were responsible for 17,908 deaths in the Industrial experience of the five cooperating companies during the period 1916 to 1920. This is equivalent to a death rate of 15.6 per 100,000 policyholders. The deaths classified under the heading "diseases of the arteries" were certified, for the most part, as due to arteriosclerosis, or hardening of the arteries. There are included also, a much smaller but nevertheless considerable number of deaths from aneurysm. Unfortunately, no differentiation of the mortality from these very dissimilar conditions is provided for by the International Classification of Causes of Death, which is the standard classification followed in this report. It is necessary in this study, therefore, to

treat all arterial conditions as a group. This is particularly unfortunate in view of the fact that it is now recognized that aneurysm is very frequently a sequela of syphilis, and that when certified as the cause of death of a person under fifty or even fifty-five years of age, there is a strong presumption that syphilitic infection was the primary causative factor and, consequently, the disease to which the death should have been charged.

Arterial diseases cause few deaths in the lower age groups. In this Industrial insurance experience they begin to assume importance in the age period 45 to 54 years, in which 1,110 deaths were recorded during the five-year period 1916 to 1920, with a death rate of 11.4 per 100,000. It is probable that in this group a considerable proportion of the deaths reported was due to aneurysm. In the higher age groups the mortality from arterial diseases increased sharply with each period, and the maximum death rate was reached at ages 75 and over. At this time of life diseases of the arteries ranked fifth in numerical importance among the causes of death of the Industrial policyholders of the five cooperating companies. Heart disease, cerebral hemorrhage, Bright's disease and pneumonia were the only conditions for which higher death rates were registered.

The following table shows the number of deaths and the death rates per 100,000 Industrial policyholders of the five cooperating companies for all ages combined and for each significant age group during the five-year period 1916 to 1920:

TABLE 92

Deaths and Death Rates per 100,000 from Diseases of Arteries. Intercompany Industrial Mortality Experience, 1916 to 1920, by Age Periods

AGE PERIODS	Number of Deaths	Death Rates per 100,000
All ages—one and over	17,908	15.6
1 to 4	11	.1
5 to 9	7	*
10 to 14	7	*
15 to 19	14	.1
20 to 24	25	.2
25 to 34	140	.7
35 to 44	387	2.9
45 to 54	1,110	11.4
55 to 64	3,376	52.9
65 to 74	6,797	265.2
75 and over	6,034	1105.7

* Rate less than .05 per 100,000.

The following table presents for the Industrial policyholders of the five cooperating companies and for the population of the United States Registration Area (Ages 1 to 74 years), the number of deaths and the death rates per 100,000, for diseases of the arteries, for each year of the quinquennium 1916 to 1920:

TABLE 93

Deaths and Death Rates per 100,000 from Diseases of Arteries. Intercompany Industrial Mortality Experience and United States Registration Area (Ages 1 to 74 Years), Compared for Period 1916 to 1920

YEAR	DEATH RATES PER 100,000			NUMBER OF DEATHS	
	Interco. Ind'l.	U. S. Reg. Area	Per cent. Interco. of U. S. Reg. Area	Interco. Ind'l.	U. S. Reg. Area
1916 to 1920.....	15.6	10.9	143.1	17,908	41,781
1920	15.6	10.1	154.5	4,019	8,371
1919	13.7	10.0	137.0	3,351	8,179
1918	15.0	11.1	135.1	3,434	8,707
1917	17.0	12 0	141.7	3,638	8,661
1916	17.3	11.4	151.8	3,466	7,863
Per cent. decrease 1916-1920	9.8	11.4	....	....	....

The figures in the above table show that there was a slight downward trend of the reported mortality from arterial diseases. It should be remembered, however, that these conditions, especially arteriosclerosis, are usually associated with either cardiac or renal lesions, or with both. When a physician states on the death certificate that chronic heart or chronic kidney disease was present with arteriosclerosis, the standard statistical practice is to classify the death under heart disease, or kidney disease, rather than under the arterial lesion. It is probable that the slightly lower arterial disease mortality rates of 1918, 1919 and 1920 may be attributed to the increased reporting of cardiac and renal disease involvements, rather than to any *actual* decline in the death rate of Industrial policyholders from arterial disease.

The death rate for diseases of the arteries is higher among the wage-earning group than in the general population. This is shown clearly by the above table and applies to the quinquennium as a

whole as well as to each separate year. The following table enables us to compare the mortality of the two experiences by age periods and shows that in each significant period the death rate of the Industrial policyholders was much higher than that of the general population:

TABLE 94

Death Rates per 100,000 from Diseases of Arteries. Intercompany Industrial Mortality Experience and United States Registration Area (Ages 1 to 74 Years), Compared by Age Periods for Quinquennium 1916 to 1920

AGE PERIODS	Interco. Ind'l.	U. S. Reg. Area	Per cent. Interco. Ind'l. of U. S. Reg. Area
All ages—one and over*	15.6	10.9	143.1
1 to 4	.1	†	....
5 to 9	†	†	....
10 to 14	†	.1	....
15 to 19	.1	.1	100.0
20 to 24	.2	.3	66.7
25 to 34	.7	.9	77.8
35 to 44	2.9	3.4	85.3
45 to 54	11.4	10.6	107.5
55 to 64	52.9	43.6	121.3
65 to 74	265.2	181.9	145.8

* Ages 1 to 74 years for U. S. Reg. Area.
† Rate less than .05 per 100,000.

XVII. DIABETES

Diabetes caused 17,617 deaths among the Industrial policyholders of the five cooperating companies during the five year period 1916 to 1920. This is equivalent to a death rate of 15.4 per 100,000. The mortality from diabetes constituted 1.3 per cent. of the deaths from all causes. At the earlier ages it is relatively unimportant as a cause of death, although the disease usually takes an acute rather than a chronic course in childhood and is almost invariably fatal. After age five there was in the experience of the Industrial policyholders a more or less decided rise in the death rate with each higher age group up to the period 25 to 34 years. Beginning with age 35, the disease became an important cause of death and sharp increases were recorded in the age periods 45 to 54, 55 to 64 and 65 to 74 years with the maximum rate in the highest age group, 75 years and over. Diabetes at ages 45 to 54 caused 1.9 per cent. of the mortality from all causes; at ages 55 to 64, 2.8 per cent. of all the deaths were

charged to this disease; at 65 to 74 years, 2 per cent., and at 75 years and over 0.9 per cent. of the total mortality was due to diabetes.

The following table shows by significant age groups the number of deaths from diabetes, and the death rates per 100,000 among the Industrial policyholders of the five cooperating companies for the quinquennium 1916 to 1920:

TABLE 95

Deaths and Death Rates per 100,000 from Diabetes. Intercompany Industrial Mortality Experience, 1916 to 1920 By Age Periods

AGE PERIODS	Number of Deaths	Death Rates per 100,000
All ages—one and over	17,617	15.4
1 to 4	211	2.0
5 to 9	301	1.9
10 to 14	531	3.9
15 to 19	569	4.7
20 to 24	593	5.2
25 to 34	1,123	6.0
35 to 44	1,253	9.5
45 to 54	3,175	32.7
55 to 64	5,549	86.9
65 to 74	3,492	136.2
75 and over	820	150.3

Unfortunately, no figures for the Industrial policyholders are available for years prior to 1916. In the general population a small but well-defined upward trend in the death rate for this disease was observed from 1900 to 1915. Beginning with 1916 the course of the disease among the wage-earning group of the population has been very similar to that observed in the Registration Area. A continuous decline was shown for each group from 1916 to 1919, but in 1920 a rise was observed in each experience. It is difficult to account for the downward trend that took place between 1916 and 1919. It has been suggested that this decline was dependent upon the changes in the diet of the American people incidental to war, as well as to the better wages, housing and general economic conditions which prevailed during these years, especially among the wage-earners.

The following table presents for the Industrial policyholders of the five cooperating companies and for the population of the United

States Registration Area, aged one to 74 years, the death rates for diabetes for each year of the quinquennium 1916 to 1920:

TABLE 96

Deaths and Death Rates per 100,000 from Diabetes. Intercompany Industrial Mortality Experience and United States Registration Area (Ages 1 to 74 Years), Compared for Period 1916 to 1920

YEAR	DEATH RATES PER 100,000			NUMBER OF DEATHS	
	Interco. Ind'l.	U. S. Reg. Area	Per cent. Interco. of U. S. Reg. Area	Interco. Ind'l.	U. S. Reg. Area
1916 to 1920.....	15.4	14.8	104.1	17,617	57,081
1920	15.3	14.8	103.4	3,951	12,245
1919	14.0	13.7	102.2	3,418	11,257
1918	14.6	14.7	99.3	3,332	11,524
1917	16.3	15.5	105.2	3,503	11,237
1916	17.0	15.7	108.3	3,413	10,818
Per cent decrease 1916-1920	10.0	5.7	....	....	....

It will be observed that there was very little difference between the rates, year after year, of the wage-earners and the general population. The figures for the former were a little higher. Prior studies of the mortality from this disease among comparable groups of wage-earners and the general population have also pointed to a higher mortality among the former, a finding that is opposed to the prevailing idea that people of higher economic status suffer more from this disease than do the wage-earning groups. Comparison of the two experiences by age groups shows that after age 45, when three-quarters of the deaths occur, the mortality of the insured at every age period was markedly higher than that of the general population. In childhood, the contrary is true, but the mortality was very low for both experiences.

The following table presents the death rates for diabetes for the Industrial policyholders of the five cooperating companies and for the general population of the United States Registration Area (ages 1 to 74 years) compared for each significant age group:

TABLE 97

Death Rates per 100,000 from Diabetes. Intercompany Industrial Mortality Experience and United States Registration Area (Ages 1 to 74 Years), Compared by Age Periods for Quinquennium 1916 to 1920

AGE PERIODS	Interco. Ind'l.	U. S. Reg. Area	Per cent. Interco. Ind'l. of U. S. Reg. Area
All ages—one and over*.....	15.4	14.8	104.1
1 to 4.....	2.0	2.3	87.0
5 to 9.....	1.9	2.7	70.4
10 to 14.....	3.9	4.3	90.7
15 to 19.....	4.7	4.3	109.3
20 to 24.....	5.2	4.3	120.9
25 to 34.....	6.0	5.5	109.1
35 to 44.....	9.5	8.5	111.8
45 to 54.....	32.7	24.3	134.6
55 to 64.....	86.9	70.1	124.0
65 to 74.....	136.2	115.6	117.8

* Ages 1 to 74 years for U. S. Reg. Area.

XVIII. APPENDICITIS

Appendicitis, with 12,844 deaths and a death rate of 11.2 per 100,000 caused in the five years covered by this report a little less than one per cent. of the deaths from all causes among the Industrial policyholders of the five companies cooperating in this study.

The following table shows by significant age groups the number of deaths from appendicitis and the death rates per 100,000 among the Industrial policyholders of the five cooperating companies for the quinquennium 1916 to 1920:

TABLE 98

Deaths and Death Rates per 100,000 from Appendicitis. Intercompany Industrial Mortality Experience, 1916 to 1920 By Age Periods

AGE PERIODS	Number of Deaths	Death Rates per 100,000
All ages—one and over	12,844	11.2
1 to 4	588	5.6
5 to 9	1,525	9.7
10 to 14	1,747	12.7
15 to 19	1,735	14.4
20 to 24	1,483	12.9
25 to 34	2,137	11.4
35 to 44	1,433	10.9
45 to 54	1,152	11.9
55 to 64	743	11.6
65 to 74	226	8.8
75 and over	75	13.7

Appendicitis mortality statistics show a fairly uniform death rate for all the age periods with the exception of ages one to four. This disease has less age incidence than any of the conditions that are separately classified in this report. The highest death rate for appendicitis is that for the age period 15 to 19 years followed closely by those for 20 to 24 and 10 to 14 years. The age distribution of the mortality from appendicitis more nearly resembles that for typhoid fever than any other cause of death.

The following table presents for the Industrial policyholders of the five cooperating companies the number of deaths and the death rates per 100,000 for appendicitis for each year of the quinquennium 1916 to 1920:

TABLE 99

Deaths and Death Rates per 100,000 from Appendicitis. Intercompany Industrial Mortality Experience and United States Registration Area (Ages 1 to 74 Years), Compared for Period 1916 to 1920

Year	Death Rates per 100,000			Number of Deaths	
	Interco. Ind'l.	U. S. Reg. Area	Per cent. Interco. of U. S. Reg. Area	Interco. Ind'l.	U. S. Reg. Area
1916 to 1920.....	11.2	12.5	89.6	12,844	48,038
1920	12 4	13.4	92.5	3,192	11,121
1919	10.4	12.0	86.7	2,536	9,850
1918	10.6	12.2	86.9	2,421	9,541
1917	11.0	11.8	93.2	2,369	8,550
1916	11.6	13.1	88.5	2,326	8,976
Per cent. increase 1916-1920	6.9	2.3	....	....	....

The death rate during the five-year period was fairly stationary. There were no material differences during the quinquennium between the mortality from this disease among the Industrial policyholders and the general population.

XIX. CIRRHOSIS OF THE LIVER

Cirrhosis of the liver caused 11,612 deaths in this insurance experience, which is equivalent to a death rate of 10.1 per 100,000. Although of little importance as a cause of death before age 35, this disease was responsible for a considerable mortality in each of the subsequent age periods. The death rate increased sharply with each of the higher age groups. Cirrhosis of the liver caused 1.2 per cent. of the total mortality at ages 35 to 44, 1.9 per cent. in the age group 45 to 54; 1.6 per cent. at 55 to 64; 1.1 per cent. at 65 to 74 and 0.7 per cent. at 75 years and over.

The following table shows the number of deaths and the death rates per 100,000 for the Industrial policyholders of the five cooperating companies for each significant age group during the five-year period 1916 to 1920:

TABLE 100

Deaths and Death Rates per 100,000 from Cirrhosis of Liver. Intercompany Industrial Mortality Experience, 1916 to 1920 By Age Periods

AGE PERIODS	Number of Deaths	Death Rates per 100,000
All ages—one and over	11,612	10.1
1 to 4	39	.4
5 to 9	31	.2
10 to 14	38	.3
15 to 19	25	.2
20 to 24	74	.6
25 to 34	635	3.4
35 to 44	1,875	14.3
45 to 54	3,113	32.0
55 to 64	3,248	50.9
65 to 74	1,928	75.2
75 and over	606	111.0

The trend of the death rate for cirrhosis of the liver during the five years covered by this report was steadily and continuously downward both among the wage-earners and in the general population. As a matter of fact this downward trend has been observed in the general population for twenty years and has been continuous since 1911. As the principal cause of cirrhosis of the liver is alcoholism, for which disease the death rate has also shown a declining tendency for two decades, the chief reason for the downward trend of the cirrhosis of the liver death rate is undoubtedly a diminished use of alcoholic liquors to excess, a phenomenon which has been observed for many years.

The following table presents for the Industrial policyholders of the five cooperating companies and for the general population of the United States Registration Area the number of deaths and the death rates per 100,000 for cirrhosis of the liver for each year of the quinquennium 1916 to 1920:

TABLE 101

Deaths and Death Rates per 100,000 from Cirrhosis of Liver. Intercompany Industrial Mortality Experience and United States Registration Area (Ages 1 to 74 Years), Compared for Period 1916 to 1920

YEAR	DEATH RATES PER 100,000			NUMBER OF DEATHS	
	Interco. Ind'l.	U. S. Reg. Area	Per cent. Interco. of U. S. Reg. Area	Interco. Ind'l.	U. S. Reg. Area
1916 to 1920.....	10.1	8.5	118.8	11,612	32,589
1920	6.3	6.2	101.6	1,625	5,113
1919	7.7	6.9	111.6	1,875	5,670
1918	9.9	8.7	113.8	2,257	6,817
1917	13.3	9.9	134.3	2,861	7,121
1916	14.9	11.4	130.7	2,994	7,868
Per cent. decrease 1916-1920	57.7	45.6	....	....	....

The cirrhosis death rate of the insured for the five-year period exceeded that of the general population by 19 per cent. In the early years of the quinquennium 1916 and 1917 the excess in the death rates for the policyholders were much greater than at the end of the five-year period. In fact, the rates for the two experiences were almost identical in 1920. Comparing the mortality of the two experiences in the first and final years we find that there was a decline of 58 per cent. in cirrhosis of the liver mortality among the insured as compared with one of 46 per cent. for the general population.

The following table presents the rates for cirrhosis of the liver for the Industrial policyholders of the five cooperating companies and for the general population of the United States Registration Area (ages 1 to 74 years) compared for each significant age group:

TABLE 102

Death Rates per 100,000 from Cirrhosis of Liver. Intercompany Industrial Mortality Experience and United States Registration Area (Ages 1 to 74 Years), Compared by Age Periods for Quinquennium 1916 to 1920

AGE PERIODS	Interco. Ind'l.	U. S. Reg. Area	Per cent. Interco. Ind'l. of U. S. Reg. Area
All ages—one and over*.....	10.1	8.5	118.8
1 to 4.....	.4	.4	100.0
5 to 9.....	.2	.2	100.0
10 to 14.....	.3	.3	100.0
15 to 19.....	.2	.3	66.7
20 to 24.....	.6	.5	120.0
25 to 34.....	3.4	2.2	154.5
35 to 44.....	14.3	8.2	174.4
45 to 54.....	32.0	20.2	158.4
55 to 64.....	50.9	40.1	126.9
65 to 74.....	75.2	61.7	121.9

* Ages 1 to 74 years for U. S. Reg. Area.

The above table shows that the cirrhosis of the liver death rate of the insured was much higher than that of the general population at all of the age periods in which the relatively high rates for each experience prevailed.

XX. TYPHOID FEVER

Typhoid fever caused 9,502 deaths among these Industrial policyholders during the period 1916 to 1920. This corresponded to a death rate of 8.3 per 100,000 persons insured.

The study of the typhoid death rate among this group of Industrial policyholders is of peculiar interest. There is no better gauge of the progress of sanitation in any community, or in any group of the population, than is afforded by the facts for this disease. It is important, therefore, to determine whether among the wage-earners of our cities and their families, sanitary agencies have waged as successful a battle against typhoid as in the general population. It will afford great satisfaction to health officers and sanitarians to learn that the typhoid fever death rate of these Industrial policyholders declined continuously throughout the five-year period 1916 to 1920. The figure for the latest year, 1920, was 5.7 per 100,000, which is only a very little more than one-half of the 1916 figure (11.2). In

the general population of the expanding Registration Area there was also a material reduction in the typhoid death rate; but this has not been so pronounced as in the insurance experience.

The following table shows the number of deaths and the death rate for typhoid fever for the Industrial policyholders of the five cooperating companies, and for the population of the expanding Registration Area between the ages of one and seventy-four years, for each year of the five-year period 1916 to 1920.

TABLE 103

Deaths and Death Rates per 100,000 from Typhoid Fever. Intercompany Industrial Mortality Experience and United States Registration Area (Ages 1 to 74 Years), Compared for Period 1916 to 1920

YEAR	DEATH RATES PER 100,000			NUMBER OF DEATHS	
	Interco. Ind'l.	U. S. Reg. Area	Per cent. Interco. of U. S. Reg. Area	Interco. Ind'l.	U. S. Reg. Area
1916 to 1920.....	8.3	11.3	73.5	9,502	43,386
1920	5.7	7.8	73.1	1,469	6,463
1919	6.2	9.4	66.0	1,527	7,706
1918	9.3	12.7	73.2	2,133	9,971
1917	9.9	13.7	72.3	2,123	9,882
1916	11.2	13.6	82.4	2,250	9,364
Per cent. decrease 1916-1920	49.1	42.6	....	....	....

Typhoid fever shows its highest death rates between the ages of fifteen and thirty-five years. This has long been recognized and the insurance experience conforms with and supplements that of the general population. Over one-half of the deaths were of persons of these age groups. The highest death rate was for those aged fifteen to nineteen years (14.0 per 100,000), closely followed by that for persons of the age group twenty to twenty-four years (12.3). Analysis of the age incidence of fatal cases of typhoid brings out clearly the fact that no age group is exempt. The disease is an important cause of death in childhood. Between the ages of five and fifteen years it causes almost as many deaths as does scarlet fever, many more than measles, and has over three times the mor-

tality of whooping cough. In middle life it ranks close to diabetes in numerical importance. In old age the typhoid death rate is by no means negligible.

The following table shows the number of deaths from typhoid fever and the death rates per 100,000 Industrial policyholders in the combined experience of these five leading companies, by specified age groups:

TABLE 104

Deaths and Death Rates per 100,000 from Typhoid Fever. Intercompany Industrial Mortality Experience, 1916 to 1920, By Age Periods

AGE PERIODS	Number of Deaths	Death Rates per 100,000
All ages—one and over	9,502	8.3
1 to 4	552	5.3
5 to 9	960	6.1
10 to 14	1,156	8.4
15 to 19	1,685	14.0
20 to 24	1,417	12.3
25 to 34	1,752	9.3
35 to 44	941	7.2
45 to 54	585	6.0
55 to 64	308	4.8
65 to 74	126	4.9
75 and over	20	3.7

XXI. ACUTE POLIOMYELITIS

Of the 3,722 deaths from acute poliomyelitis among the Industrial policyholders of the five cooperating companies, 2,827, or 76 per cent., occurred during the year 1916. In this year there occurred an epidemic of the disease which prevailed, for the most part, in the Middle Atlantic and New England States, although the death rate also increased appreciably over most of the rest of the country, particularly in Michigan and Minnesota.

The following table gives the number of deaths and the death rates among the Industrial policyholders of the five cooperating companies and among the general population of the Registration Area for each year of the five-year period 1916 to 1920:

TABLE 105

Deaths and Death Rates per 100,000 from Acute Poliomyelitis. Intercompany Industrial Mortality Experience and United States Registration Area (Ages 1 to 74 Years), Compared for Period 1916 to 1920

YEAR	DEATH RATES PER 100,000			NUMBER OF DEATHS	
	Interco. Ind'l.	U. S. Reg. Area	Per cent. Interco. Ind'l. of U. S. Reg Area	Interco. Ind'l.	U. S. Reg. Area
1916 to 1920.....	3.2	2.4	133.3	3,722	9,134
1920	.8	.8	100.0	217	652
1919	.5	.8	62.5	131	627
1918	.9	1.1	81.8	216	829
1917	1.5	1.4	107.1	331	977
1916	14.1	8.8	160.2	2,827	6,049
Per cent. decrease 1916-1920	94.3	90.9	....	....	....

Acute poliomyelitis has a very distinct age incidence. It is primarily a disease of early childhood, although adults are by no means immune. The age period one to four years shows the highest death rate. The highest mortality occurs in the second year of life followed closely by that for the first year. Mortality figures for the latter are not included as the infants under one year of age were not insured. In this insurance experience 59.4 per cent. of the total mortality occurred at ages one to four years, 26.8 per cent. at ages five to nine years, and 7.3 per cent. in the age period 10 to 14 years. Thus, 93.5 per cent. of the deaths were among those between one and fifteen years of age.

The following table shows the number of deaths and the death rate per 100,000 Industrial policyholders of the five cooperating companies for all ages combined and for each significant age group during the five-year period 1916 to 1920:

TABLE 106

Deaths and Death Rates per 100,000 from Acute Poliomyelitis. Intercompany Industrial Mortality Experience, 1916 to 1920, By Age Periods

AGE PERIODS	Number of Deaths	Death Rates per 100,000
All ages—one and over	3,722	3.2
1 to 4	2,211	21.1
5 to 9	999	6.3
10 to 14	273	2.0
15 to 19	96	.8
20 to 24	60	.5
25 to 34	45	.2
35 to 44	15	.1
45 to 54	7	.1
55 to 64	10	.2
65 to 74	6	.2
75 and over	....	..

XXII. CEREBROSPINAL FEVER

Cerebrospinal fever caused the deaths of 1,724 Industrial policy-holders of the five cooperating companies during the five-year period 1916 to 1920. This is equivalent to a death rate of 1.5 per 100,000 population.

By far, the highest death rate in any of the significant age periods was that for ages one to four years (5.0 per 100,000), but deaths were reported in every age group, with the single exception of 75 years and over.

The following table shows the number of deaths from cerebrospinal fever, and the death rate per 100,000 Industrial policy-holders of the five cooperating companies, for all ages combined and for each age group during the five-year period 1916 to 1920.

TABLE 107

Deaths and Death Rates per 100,000 from Cerebrospinal Fever. Intercompany Industrial Mortality Experience, 1916 to 1920 By Age Periods

AGE PERIODS	Number of Deaths	Death Rates per 100,000
All ages—one and over	1,724	1.5
1 to 4	521	5.0
5 to 9	293	1.9
10 to 14	184	1.3
15 to 19	243	2.0
20 to 24	168	1.5
25 to 34	139	.7
35 to 44	84	.6
45 to 54	56	.6
55 to 64	28	.4
65 to 74	8	.3
75 and over	....	....

The above table shows that besides the maximum death rate which is reached at ages one to four, a considerable number of deaths are recorded in the other age periods of childhood, in adolescence, and early adult life. It is in the very first year of life, however, that the heaviest mortality from cerebrospinal fever usually occurs; but as no infants under one year of age were insured in Industrial life insurance companies, no figures for this age group are available in this study. The death rates for the age groups 15 to 19, 20 to 24, and even 25 to 34 years for the period 1916 to 1920 are higher than would ordinarily be experienced for these age groups. This is due to the fact that during the years 1917 and 1918 a considerable number of deaths from cerebrospinal fever occurred in mobilization camps. As a result of this, the cerebrospinal fever death rates for these age periods and for all ages were very much higher for the years 1917 and 1918 than for either of the other three years of the quinquennial period. We present below a table showing the death rates from cerebrospinal fever among the Industrial policyholders for all ages combined, and for the age groups 15 to 19, 20 to 24, and 25 to 34 years for each year of the quinquennium.

TABLE 108

Death Rates per 100,000 from Cerebrospinal Fever. by Age Periods Intercompany Industrial Mortality Experience, 1916 to 1920

AGE PERIOD	1916	1917	1918	1919	1920
All ages	1.1	2.6	2.3	.9	.8
15-19	.9	4.5	3.5	.7	.7
20-24	.5	1.3	4.1	.9	.5
25-34	.2	1.4	1.5	.4	.3

The above figures show clearly the much higher mortality at these ages in 1917 and 1918 than obtained for the three other years.

The following table presents for the Industrial policyholders of the five cooperating companies, and for the population of the United States Registration Area, ages 1 to 74 years, the death rates for cerebrospinal fever for each year of the quinquennium, 1916 to 1920:

TABLE 109

Deaths and Death Rates per 100,000 from Cerebrospinal Fever. Intercompany Industrial Mortality Experience and United States Registration Area (Ages 1 to 74 Years), Compared for Period 1916 to 1920

YEAR	DEATH RATES PER 100,000			NUMBER OF DEATHS	
	Interco. Ind'l.	U. S. Reg. Area	Per cent. Interco. of U. S. Reg. Area	Interco. Ind'l.	U. S. Reg. Area
1916 to 1920	1.5	2.0	75.0	1,724	7,560
1920	.8	1.3	61.5	199	1,080
1919	.9	1.5	60.0	218	1,201
1918	2.3	2.4	95.8	520	1,912
1917	2.6	3.1	83.9	565	2,225
1916	1.1	1.7	64.7	222	1,142
Per cent. decrease 1916-1920	27.3	23.5	....	....	....

XXIII. PELLAGRA

Pellagra is a disease with a distinct geographic incidence. Almost all of the mortality from the disease in this country is reported from the Southern states. Hence in this report pellagra was a significant

cause of death among the policyholders of only two of the cooperating companies, namely, the Life Insurance Company of Virginia and the Metropolitan Life Insurance Company, which have a large number of Industrial policyholders in Southern states. The death rates in this report are based, therefore, on the exposure of these two companies only.

Pellagra caused 1,729 deaths in this group during the five-year period 1916 to 1920, which corresponds to a death rate of 3.2 per 100,000 policyholders.

The following table shows the number of deaths from pellagra and the death rates per 100,000 for the five-year period 1916 to 1920, by significant age groups, among the Industrial policyholders of two companies.

TABLE 110

Deaths and Death Rates per 100,000 from Pellagra. Combined Experience of Life Insurance Company of Virginia and Metropolitan Life Insurance Company, 1916 to 1920, By Age Periods

AGE PERIODS	Number of Deaths	Death Rates per 100,000
All ages—one and over	1,729	3.2
1 to 4	26	.5
5 to 9	20	.3
10 to 14	10	.2
15 to 19	43	.7
20 to 24	80	1.5
25 to 34	264	3.2
35 to 44	388	6.7
45 to 54	328	7.6
55 to 64	360	12.4
65 to 74	195	16.1
75 and over	15	7.2

The disease has a distinct age incidence as is clearly shown in the above table. It is of small importance as a cause of death in infancy, childhood, adolescence and early adult life. After age 25 there is a considerable mortality and the rate increases with each important age period.

The following table shows the number of deaths and the death rates per 100,000 for pellagra for the period 1916 to 1920 and for each year of the period, for the combined experience of the Life Insurance Company of Virginia and the Metropolitan Life Insurance Company, and for the United States Registration Area:

TABLE 111

Deaths and Death Rates per 100,000 from Pellagra. Combined Experience of Life Insurance Company of Virginia and Metropolitan Life Insurance Company, and of the United States Registration Area (Ages 1 to 74 Years), Compared for Period 1916 to 1920

YEAR	DEATH RATES PER 100,000			NUMBER OF DEATHS	
	Interco. Ind'l.	U. S. Reg. Area	Per cent. Interco. of U. S. Reg. Area	Interco. Ind'l.	U. S. Reg. Area
1916 to 1920.....	3.2	3.6	88.9	1,729	13,873
1920	2.0	2.4	83.3	238	1,988
1919	2.4	3.2	75.0	278	2,629
1918	4.4	4.5	97.8	466	3,524
1917	4.1	4.8	85.4	414	3,462
1916	3.5	3.3	106.1	333	2,270
Per cent. decrease 1916-1920	42.9	27.3	....	....	....

The above table shows lower death rates for the years 1919 and 1920 than are in evidence for the other three years. A slightly increasing tendency was observed from 1916 to 1918. The highest death rate for any year (4.4 per 100,000) was that for the year 1918. The mortality declined sharply in 1919, and there was a further drop in 1920.

The disease has a distinct color incidence, negroes showing much higher mortality rates than whites. This more than accounts for the relatively higher Registration Area death rates shown in the above table; for the insurance death rates would be considerably higher than those shown if the colored exposure of the two companies were covered by this study.

Another interesting and significant item in connection with pellagra, although it is not brought out in the present study, is the decided sex incidence of the disease in this country. The history of pellagra in the United States shows that American women have higher death rates from the disease than have the men. Studies of this phase of the pellagra situation have indicated, as a matter of fact, that the death rate of females in this country is approximately three times that of males. No such pronounced sex incidence has been observed in other countries and students of the disease have

never been able to explain why such a pronounced sex incidence has prevailed in America. Pellagra is an important public health problem in certain parts of the South. It is a disease which usually runs a chronic course and consequent on which there is usually a long period of disability and loss of earning capacity.

XXIV. MALARIA

Malaria has not been an important cause of death, numerically, among the Industrial policyholders of the five companies. It caused 954 deaths, or less than one-tenth of one per cent. of all the deaths. This disease has always been much more important as a cause of physical disability than of death among insured wage-earners. Furthermore, there is far more morbidity and mortality from malaria among the colored people than among the whites. If colored policyholders were covered by the present study, much higher death rates would be shown. It is now only in some of the Southern states, and to a lesser degree, in a few of the "border states" lying between the North and South, that malaria ranks high as a cause of death. This is true, notably, of Florida, Louisiana, Mississippi and South Carolina and, probably, of other Southern states for which no authentic mortality figures are available. In these states the disease is still a very important cause of death, even among the white population.

Malaria is most fatal in early childhood and in old age. Over one-sixth of the deaths in this Industrial insurance experience were those of children aged one to four years; nearly one-fourth were those of persons fifty-five years of age and over.

The following table shows the number of deaths from malaria and the death rates per 100,000 Industrial policyholders in the combined experience of these leading companies by specified age periods:

TABLE 112

Deaths and Death Rates per 100,000 from Malaria. Intercompany Industrial Mortality Experience, 1916 to 1920 By Age Periods

AGE PERIODS	Number of Deaths	Death Rates per 100,000
All ages—one and over	954	.8
1 to 4	167	1.6
5 to 9	104	.7
10 to 14	64	.5
15 to 19	67	.6
20 to 24	62	.5
25 to 34	82	.4
35 to 44	99	.8
45 to 54	88	.9
55 to 64	118	1.8
65 to 74	82	3.2
75 and over	21	3.8

Appendix Table A, page 148, shows the death rates for malaria both among the Industrial policyholders and the Registration Area for each year of the five-year period. Appendix Table B, page 150, gives a comparison of the malaria death rates by age period in the United States Registration Area and for insured wage-earners.

APPENDIX TABLE A

Death Rates per 100,000 for Principal Causes of Death. Intercompany Industrial Experience and that of United States Registration Area (ages 1 to 74 years) Compared for the Period 1916 to 1920. By Single Calendar Years.

Causes of Death	Intercompany Industrial—Ages 1 and Over						U. S. Registration Area—Ages 1 to 74**					
	1916 to 1920	1920	1919	1918	1917	1916	1916 to 1920	1920	1919	1918	1917	1916
All causes of death	1164.9	994.5	1031.6	1547.6	1117.5	1160.9	1062.2	935.7	949.8	1396.0	1026.7	1005.5
Influenza and pneumonia	243.3	158.3	213.6	570.4	129.0	138.3	218.4	161.2	180.0	510.0	114.0	110.2
Influenza	111.5	56.7	105.1	350.6	12.5	22.9	93.1	61.6	88.7	276.0	9.9	15.3
Pneumonia—all forms	131.8	101.6	108.5	219.8	116.5	115.4	125.2	99.6	91.3	234.0	104.1	94.9
—lobar & undefined	95.2	67.7	74.1	169.4	85.3	82.4	95.3	69.1	64.6	190.8	79.7	70.9
Bronchopneumonia	36.6	33.9	34.4	50.4	31.2	33.0	30.0	30.5	26.8	43.2	24.4	24.0
Tuberculosis—all forms	154.5	124.9	144.6	169.7	170.3	170.2	133.9	112.5	125.2	148.6	145.8	141.1
Tuberculosis of the lungs	139.9	113.1	128.2	155.3	156.5	153.1	119.7	100.4	112.2	133.6	130.1	125.2
Organic diseases of heart	127.5	123.6	108.3	133.5	134.5	141.5	108.3	101.8	95.9	116.8	115.7	113.2
Bright's disease	84.0	74.5	71.5	81.9	95.8	100.7	70.0	61.8	62.5	71.1	79.4	77.9
Accidents—Total	73.2	65.4	68.2	78.1	79.4	76.8	71.3	63.7	65.3	73.6	79.5	76.7
Traumatism by fall	10.8	9.5	9.1	10.4	11.9	13.6	8.6	7.1	7.2	8.5	10.2	10.7
Automobile accidents	10.5	12.1	11.5	10.6	9.8	8.1	9.0	10.2	9.3	9.1	8.9	7.3
Accidental drowning	8.6	6.7	8.7	9.5	8.7	9.7	7.1	5.8	6.9	6.8	7.4	8.7
Burns (conflag. excepted)	8.5	7.8	8.1	8.9	9.3	8.7	7.5	7.0	7.1	7.7	8.4	7.5
Railroad accidents	7.7	6.0	6.2	9.0	9.0	8.6	9.4	7.3	7.4	10.3	11.4	11.4
Other accidents	27.1	23.3	24.6	29.7	30.7	28.1	29.7	26.3	27.4	31.2	33.2	31.1
Cancer—all forms	72.0	75.0	69.5	69.0	72.6	74.2	71.9	72.7	70.7	71.0	72.6	72.8
Cerebral hemor., apoplexy	62.8	63.5	57.2	61.3	63.6	69.3	56.8	55.9	54.1	57.0	59.3	58.2
Diphtheria and croup	22.9	23.0	22.8	21.0	25.6	21.8	14.3	14.8	14.2	13.1	15.8	13.7
Diarrhea and enteritis	21.2	16.0	16.3	23.0	25.6	26.9	23.1	17.4	18.8	26.0	28.4	26.4
Puerperal state—total	20.0	21.8	18.8	24.6	17.5	16.8	19.0	19.6	17.6	23.1	17.3	16.9
Puerperal septicemia	6.6	7.5	5.7	6.1	7.0	6.7	6.7	6.8	6.0	6.7	7.2	7.0
Puerperal albuminuria and convulsions	4.7	5.0	4.5	4.7	4.9	4.6	4.6	4.9	4.4	4.6	4.7	4.5
Accidents of pregnancy	3.1	2.9	3.0	6.3	1.5	1.5	2.8	2.8	2.5	5.4	1.4	1.4
Accidents of labor	3.0	3.3	3.1	5.2	1.6	1.6	2.6	2.7	2.5	4.2	1.6	1.8
War deaths	17.6	.7	19.9	46.5	12.6	8.9	....	....	....	....	....	....
Diseases of the arteries	15.6	15.6	13.7	15.0	17.0	17.3	10.9	10.1	10.0	11.1	12.0	11.4
Diabetes	15.4	15.3	14.0	14.6	16.3	17.0	14.8	14.8	13.7	14.7	15.5	15.7
Appendicitis	11.2	12.4	10.4	10.6	11.0	11.6	12.5	13.4	12.0	12.2	11.8	13.1
Cirrhosis of the liver	10.1	6.3	7.7	9.9	13.3	14.9	8.5	6.2	6.9	8.7	9.9	11.4
Suicides (total)	8.9	7.3	8.0	8.7	10.2	11.0	12.0	10.1	11.3	11.8	13.2	14.2
Typhoid fever	8.3	5.7	6.2	9.3	9.9	11.2	11.3	7.8	9.4	12.7	13.7	13.6
Measles	7.9	8.4	3.3	8.3	9.8	10.2	7.4	7.0	3.0	7.9	11.1	8.6
Whooping-cough	5.4	5.8	2.8	8.9	4.5	5.0	5.4	5.8	2.6	9.1	5.0	4.8
Scarlet fever	5.0	6.2	4.1	3.9	6.2	4.3	3.5	4.6	2.8	2.8	4.1	3.2
Homicides (total)	3.6	3.4	3.8	3.4	3.8	3.8	7.1	6.7	7.5	6.7	7.7	7.0
Pellagra*	3.2	2.0	2.4	4.4	4.1	3.5	3.6	2.4	3.2	4.5	4.8	3.3
Acute anterior poliomyelitis	3.2	.8	.5	.9	1.5	14.1	2.4	.8	.8	1.1	1.4	8.8
Cerebrospinal fever	1.5	.8	.9	2.3	2.6	1.1	2.0	1.3	1.5	2.4	3.1	1.7
Malaria	.8	.7	.7	.8	.9	1.1	2.9	2.9	3.3	2.7	2.7	2.6

*For Metropolitan Life Insurance Co. and Life Insurance Company of Virginia only.
**U. S. Registration States for 1920.

APPENDIX TABLE B

Death Rates per 100,000 exposed at specified age divisions for Principal Causes of Death.

Intercompany Industrial Experience and that of United States Registration Area (ages 1 to 74 years) Compared. Period 1916 to 1920.*

Cause of Death—Area	All Ages 1 and Over	1-4	5-9	10-14	15-19	20-24	25-34	35-44	45-54	55-64	65-74
All causes of death:											
Intercompany Industrial	1164.9	1205.2	355.5	259.2	494.8	800.6	1005.6	1159.6	1701.3	3118.4	6773.6
U. S. Reg. Area	1062.2	1189.0	350.7	268.6	450.2	629.3	831.0	971.2	1405.8	2705.0	5485.3
Influenza—pneumonia											
Intercompany Industrial	243.3	392.1	76.2	56.3	123.4	222.7	345.2	242.9	253.3	399.7	825.2
U. S. Reg. Area	218.4	365.8	81.4	63.1	125.0	179.2	282.0	222.1	203.3	306.0	587.2
Influenza											
Intercompany Industrial	111.5	151.1	41.0	33.4	74.3	127.6	207.5	117.7	85.9	108.2	202.4
U. S. Reg. Area	93.1	129.7	41.2	34.5	68.0	94.9	151.7	101.6	67.0	78.7	144.5
Pneumonia—all forms											
Intercompany Industrial	131.8	241.0	35.2	22.9	49.1	95.1	137.7	125.2	167.3	291.6	622.7
U. S. Reg. Area	125.2	236.1	40.2	28.5	57.0	84.4	130.4	120.5	136.3	227.3	442.7
Pneumonia-lobar & undefined											
Intercompany Industrial	95.2	100.2	21.0	17.3	41.4	81.5	118.1	106.9	138.4	221.8	415.5
U. S. Reg. Area	95.3	102.8	25.9	22.6	49.4	73.9	114.4	104.6	115.1	180.6	314.5
Bronchopneumonia											
Intercompany Industrial	36.6	140.7	14.2	5.6	7.7	13.6	19.6	18.3	28.9	69.8	207.1
U. S. Reg. Area	30.0	133.3	14.2	5.9	7.6	10.5	16.0	15.9	21.2	46.6	128.3
Tuberculosis—all forms											
Intercompany Industrial	154.5	62.0	22.3	27.1	125.4	218.5	249.3	271.7	235.6	196.4	174.4
U. S. Reg. Area	133.9	61.1	24.4	32.0	106.7	178.1	191.4	182.1	169.2	176.5	182.1
Tuberculosis of the lungs											
Intercompany Industrial	139.9	16.3	8.2	18.9	115.2	207.7	238.7	259.0	222.9	183.5	160.6
U. S. Reg. Area	119.7	20.2	10.8	23.2	96.6	166.3	180.1	171.0	157.5	161.7	164.2
Organic diseases of the heart											
Intercompany Industrial	127.5	7.1	13.9	23.6	28.7	29.1	44.3	91.3	206.0	540.8	1494.0
U. S. Reg. Area	108.3	6.7	11.8	18.2	19.3	21.7	35.1	72.3	162.5	444.0	1136.8
Bright's disease											
Intercompany Industrial	84.0	4.3	3.5	4.8	8.2	13.3	27.2	74.4	174.2	392.3	934.7
U. S. Reg. Area	70.0	4.9	3.5	4.4	6.6	10.4	20.3	51.3	126.7	305.6	688.8
Accidents—Total											
Intercompany Industrial	73.2	90.7	58.3	46.1	58.0	56.3	55.4	68.0	90.3	128.6	225.1
U. S. Reg. Area	71.3	88.3	53.2	41.7	51.7	55.6	61.1	73.9	89.0	116.0	170.6
Traumatism by fall											
Intercompany Industrial	10.8	8.7	3.5	2.9	3.2	3.8	5.8	10.1	16.5	30.0	80.1
U. S. Reg. Area	8.6	7.1	3.5	2.8	2.8	3.4	5.2	8.2	12.5	22.6	57.0
Automobile accidents											
Intercompany Industrial	10.5	10.6	19.3	11.3	7.2	7.0	6.4	7.2	9.1	15.1	22.4
U. S. Reg. Area	9.0	7.4	15.0	8.1	5.9	6.4	6.6	7.8	10.1	14.8	18.4
Accidental drowning											
Intercompany Industrial	8.6	5.6	9.8	11.8	14.9	11.1	6.5	5.4	5.8	5.3	5.6
U. S. Reg. Area	7.1	6.8	7.4	9.5	11.0	8.1	5.7	5.8	5.9	5.2	4.7
Burns (conflagration excepted)											
Intercompany Industrial	8.5	41.1	9.2	2.4	2.9	2.8	3.3	4.3	6.1	9.4	16.5
U. S. Reg. Area	7.5	38.8	9.9	2.7	2.7	3.1	3.3	3.7	4.4	6.5	10.7
Railroad accidents											
Intercompany Industrial	7.7	1.4	3.0	3.6	8.2	10.4	9.9	9.3	10.3	13.5	16.4
U. S. Reg. Area	9.4	1.5	2.4	3.1	7.0	10.2	11.6	13.4	14.5	16.3	16.3
Cancer—all forms											
Intercompany Industrial	72.0	3.6	1.7	1.5	2.8	4.5	16.0	74.5	205.0	400.9	668.3
U. S. Reg. Area	71.9	3.5	1.8	1.7	2.8	4.7	14.7	57.6	161.4	357.8	593.0
Cerebral hemorrhage, apoplexy											
Intercompany Industrial	62.8	1.8	.5	.6	1.3	2.2	5.8	26.7	109.4	327.3	893.1
U. S. Reg. Area	56.8	1.7	.9	.8	1.6	2.4	6.1	23.6	90.0	279.1	713.8
Diphtheria and croup											
Intercompany Industrial	22.9	130.8	59.3	13.8	3.7	1.9	1.5	1.0	.8	.7	.6
U. S. Reg. Area	14.3	92.0	43.3	10.9	3.2	1.7	1.3	1.0	1.0	.8	.8
Diarrhea and enteritis											
Intercompany Industrial	21.2	164.6	7.0	1.7	1.1	1.9	3.1	4.8	7.6	16.6	52.5
U. S. Reg. Area	23.1	197.2	8.4	2.2	1.6	2.1	3.3	5.1	8.6	16.5	41.0
Puerperal state—total											
Intercompany Industrial	20.0	....	....	.1	15.5	49.0	56.7	35.6	1.6	.1	....
U. S. Reg. Area	19.0	....	....	.5	17.8	41.2	47.8	30.5	2.0	....	....
Puerperal septicemia											
Intercompany Industrial	6.6	....	....	.1	5.4	17.2	18.4	10.9	.5	....	....
U. S. Reg. Area	6.7	....	....	.2	6.6	15.8	17.0	9.6	.6	....	....

*U. S. Reg. States for 1920.

APPENDIX TABLE B (Continued)

Death Rates per 100,000 exposed at specified age divisions for Principal Causes of Death.

Intercompany Industrial Experience and that of United States Registration Area (ages 1 to 74 years) Compared. Period 1916 to 1920.*

Cause of Death—Area	All Ages† 1 and Over	1-4	5-9	10-14	15-19	20-24	25-34	35-44	45-54	55-64	65-74
Puerperal albuminuria and convulsions											
Intercompany Industrial..	4.7	....	....	....	5.6	12.7	11.6	8.3	.3	....	....
U. S. Reg. Area.....	4.6	....	....	.2	6.8	10.9	10.1	7.0	.5	....	....
Accidents of pregnancy											
Intercompany Industrial..	3.1	....	....	....	1.9	7.5	9.9	4.6	.2	....	....
U. S. Reg. Area.....	2.8	....	....	....	1.7	5.8	8.0	4.0	.2	....	....
Accidents of labor											
Intercompany Industrial..	3.0	....	....	....	1.7	7.1	9.4	5.0	.3	....	....
U. S. Reg. Area.....	2.6	....	....	....	1.9	5.4	6.8	4.3	.3	....	....
War deaths											
Intercompany Industrial.....	17.6	....	....	....	20.7	76.8	40.1	9.3	1.2	.2	.5
U. S. Reg. Area.....	....	....	....	....	....	....	....	....	....	....	....
Diseases of the arteries											
Intercompany Industrial.....	15.6	.1	....	....	.1	.2	.7	2.9	11.4	52.9	265.2
U. S. Reg. Area.....	10.9	....	....	.1	.1	.3	.9	3.4	10.6	43.6	181.9
Diabetes											
Intercompany Industrial.....	15.4	2.0	1.9	3.9	4.7	5.2	6.0	9.5	32.7	86.9	136.2
U. S. Reg. Area.....	14.8	2.3	2.7	4.3	4.3	4.3	5.5	8.5	24.3	70.1	115.6
Appendicitis											
Intercompany Industrial.....	11.2	5.6	9.7	12.7	14.4	12.9	11.4	10.9	11.9	11.6	8.8
U. S. Reg. Area.....	12.5	5.8	10.7	14.1	14.5	12.4	12.4	13.2	14.2	14.6	12.9
Cirrhosis of the liver											
Intercompany Industrial.....	10.1	.4	.2	.3	.2	.6	3.4	14.3	32.0	50.9	75.2
U. S. Reg. Area.....	8.5	.4	.2	.3	.3	.5	2.2	8.2	20.2	40.1	61.7
Suicides—total											
Intercompany Industrial.....	8.9	....	....	.5	4.3	9.0	12.5	15.8	19.6	22.6	26.1
U. S. Area.....	12.0	....	....	.5	4.3	9.1	14.0	18.4	23.9	31.1	31.8
Typhoid fever											
Intercompany Industrial.....	8.3	5.3	6.1	8.4	14.0	12.3	9.3	7.2	6.0	4.8	4.9
U. S. Reg. Area.....	11.3	6.4	8.7	11.9	18.4	16.2	12.4	9.7	8.9	8.4	8.0
Measles											
Intercompany Industrial.....	7.9	67.2	8.6	1.5	1.0	.7	.5	.4	.4	.3	.3
U. S. Reg. Area.....	7.4	58.1	8.9	3.0	3.1	2.0	1.2	1.3	1.3	1.4	2.1
Whooping cough											
Intercompany Industrial.....	5.4	52.3	3.7	.2	.1	....	.1	.1	....	.1	.1
U. S. Reg. Area.....	5.4	55.4	5.0	.8	.2	.1	.1	.1	.1	.1	.2
Scarlet fever											
Intercompany Industrial.....	5.0	24.6	12.0	4.0	2.1	1.6	.9	.3	.2	.1	.1
U. S. Reg. Area.....	3.5	18.2	9.9	3.5	2.1	1.5	.9	.4	.2	.1	.1
Homicides											
Intercompany Industrial.....	3.6	.8	.8	.7	3.5	6.4	6.6	6.0	4.2	2.9	2.6
U. S. Reg. Area.....	7.1	1.0	.8	1.0	5.0	10.7	13.1	11.7	8.1	5.2	3.6
Pellagra†											
Intercompany Industrial.....	3.2	.5	.3	.2	.7	1.5	3.2	6.7	7.6	12.4	16.1
U. S. Reg. Area.....	3.6	.7	.6	.6	1.4	2.7	3.8	5.5	6.2	8.3	12.0
Acute anterior poliomyelitis											
Intercompany Industrial.....	3.2	21.1	6.3	2.0	.8	.5	.2	.1	.1	.2	.2
U. S. Reg. Area.....	2.4	16.1	4.9	1.8	1.0	.6	.4	.2	.2	.3	.4
Cerebrospinal fever											
Intercompany Industrial.....	1.5	5.0	1.9	1.3	2.0	1.5	.7	.6	.6	.4	.3
U. S. Reg. Area.....	2.0	7.7	3.2	2.2	2.0	1.5	1.0	.9	.8	.6	.3
Malaria											
Intercompany Industrial.....	.8	1.6	.7	.5	.6	.5	.4	.8	.9	1.8	3.2
U. S. Reg. Area.....	2.9	7.0	3.3	2.1	2.2	2.0	1.6	2.1	2.6	3.9	6.7

†For M. L. I. Co. and L. I. Co. of Va. only.
*U. S. Reg. States for 1920.

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